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## STUDIES OF THE BACTERICIDAL TREATMENT OF MILK CANS IN HOT-AIR CABINETS

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In view of the fact that hot-air cabinets for the bactericidal treatment of milk utensils and containers are coming into wider use by the dairy industry, it appeared desirable to conduct experiments to determine an effective and practicable temperature and holding time that will insure the desired reduction of milk-borne pathogens.

In conducting the experimental work the following principles were considered important:

(1) It would be faulty merely to test several commercial models of hot-air cabinets and to conclude that the temperature and holding time combination which was found to be effective for such cabinets would be effective for all hot-air cabinets. Hot-air cabinets usually show large simultaneous variations in internal temperature, and the commercially placed thermometers are not in all cases located in the coldest zone. Again, the maximum internal temperature differences vary with the size of the cabinet, its shape, the material of which it is constructed, the manner in which it is baffled, if at all, the manner in which the hot air is introduced, the manner in which the cabinet is vented, and the arrangement, amount, and type of contents to be treated.

Hence, if the cabinet tested is poorly constructed, the derived temperature and holding time will be higher than is really necessary for better constructed cabinets, and, conversely, if the cabinet tested is one of the best types the derived temperature and holding time would be inadequate for any less perfect cabinet.

Hence, in conducting such tests it was considered necessary either to determine the actual air temperature immediately surrounding each individual piece of equipment, or to reduce the variations in temperature within the test cabinet to a minimum at least as low as the lowest variations which would be likely to occur in commercial cabinets. This latter can be done by means of an electric fan, and this procedure was used in our tests. If now the temperature and

time combination so derived is applied in practice, only one requirement need be made to insure effectiveness and fairness for all cabinets, namely, that the thermometer must be located in the coldest zone. This determination should be made by the manufacturers and checked by the health department.

(2) It would be faulty to test the effectiveness of hot-air treatment by determining the reduction of the "run of the mill" bacterial flora found on dirty milk cans. Such tests would be misleading, since the holding time and temperature thus determined would obviously vary with the variations in the mean thermal resistance of the "run of the mill" flora. The mean thermal resistance of such a variable flora might be higher than that of the most heat-resistant milk-borne pathogen on some days and lower on others.

Therefore it seemed imperative that a proper criterion organism be employed in pure culture. The thermal resistance of the test organism selected should be at least equal to, but not necessarily much higher than, that of the most resistant pathogen transmissible through milk supplies.

It is generally accepted that 140° F. for 30 minutes will devitalize all milk-borne pathogens. Park (*1*) found, for example, that *B. tuberculosis* is devitalized in milk at 140° F. in 15 minutes. All of 200 strains of hemolytic streptococci from septic sore throat, scarlet fever, etc., were killed at 140° F. in 30 minutes, most of them at 136° F. or less (*2*). For our tests use was made of a pure strain of *E. coli* which was isolated several years ago from milk by one of us in our attempt to find a nonpathogenic strain which would serve as a criterion or test organism for testing the efficiency of pasteurization and heat sterilization processes. This pure strain, when tested by laboratory methods similar to those used in Park's tests with pathogens, was found to be devitalized in milk at 140° F. in 51 minutes. The criterion organism was therefore somewhat more resistant to heat than any of the milk-borne pathogens reported in the literature.

The criterion organism, when cultured as later described and then suspended in distilled water buffered at pH 7.2 with phosphate buffers, had a thermal resistance such that a reduction of 99.99 percent was obtained at 140° F. in about 33 minutes. It was therefore assumed that a time and temperature combination which would produce a 99.99 percent reduction of this organism, plus an arbitrary margin of safety, would be satisfactory as a bactericidal treatment of dairy and milk plant equipment.

*Equipment.*—The hot-air cabinet used has a capacity of about 46 cubic feet. It is constructed of galvanized iron with double walls and top, thus giving a 1-inch air space insulation between the inner and outer walls. The space under the bottom of the cabinet was closed in with asbestos board to provide a shielded location for the gasoline

FIGURE 1.—Experimental hot air cabinet.

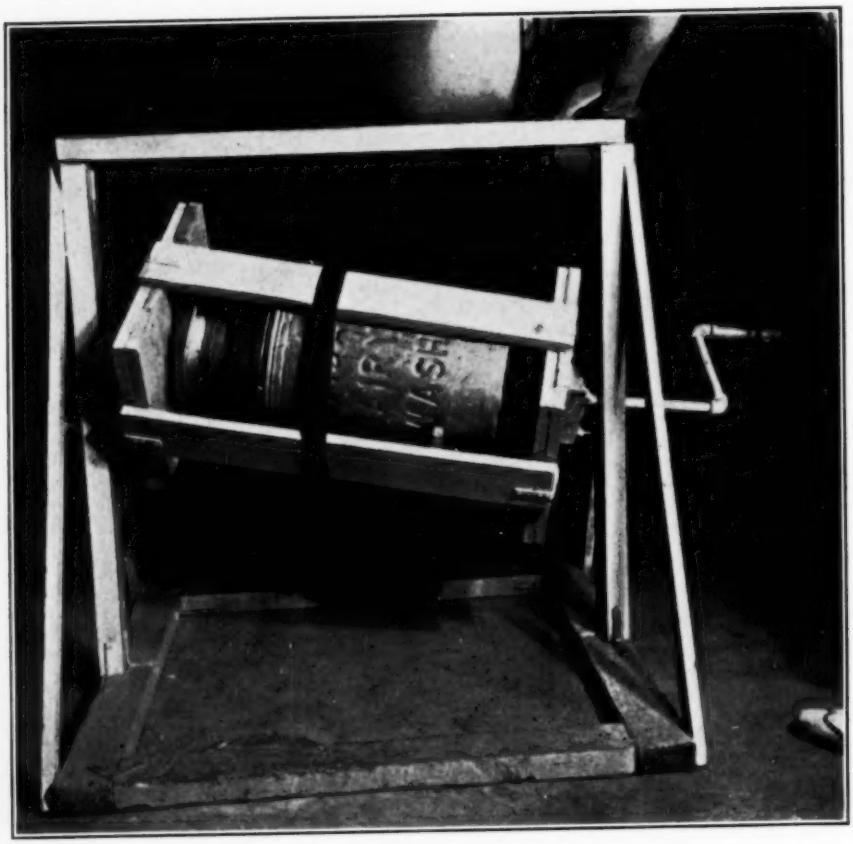


FIGURE 2.—Mechanical can shaker.

burners. A flue equipped with a damper was inserted in one side of the cabinet near the back.

To minimize differences in internal temperatures a 16-inch fan was installed in the top of the cabinet. Ten glass laboratory-type thermometers were inserted through the sides and top of the cabinet. Two 5-inch gasoline burners were used. The accompanying illustration

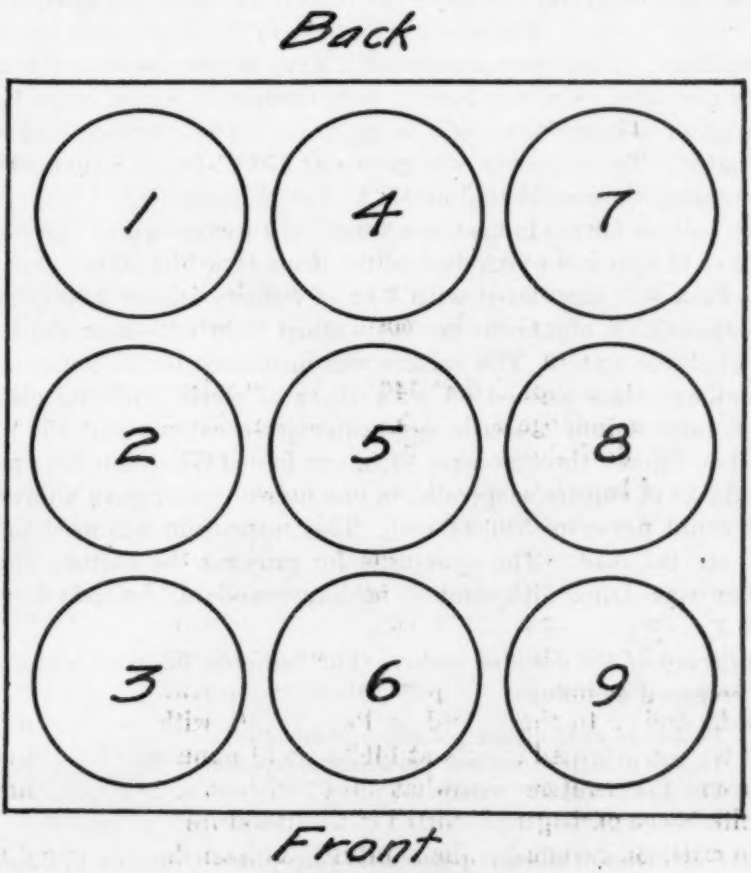



FIGURE 3.—Can locations.

(fig. 1) shows the cabinet with the front asbestos shield pulled aside and the burners pulled forward.

*Culturing of the test organism.*—The organism used has the following characteristics:

Sugar fermentation.—Sucrose negative, acid and gas in lactose, dextrose, dulcitol, maltose, salicin, mannite, and dextrin.

Indol is produced.

Nitrates are reduced to nitrites.

Motility positive.

Citrate negative.

Eosin—methylene blue agar—metallic sheen.
Agar plate colonies—bluish to gray.
Agar slant colonies—yellowish gray.

New stock cultures were made every month and, at the same time, a new transfer was started for use in the thermal resistance runs. This new culture was carried in daily transfers on agar slants and was not used for a thermal resistance run until it had been transferred daily for at least 1 week. The stock cultures and all media were stored in the ice box. Slants were incubated 2 days before use to dry out the excess moisture. Culture bottles were incubated for 24 hours before inoculation to insure the media being at incubation temperature when inoculated. The organism was grown at 37° C. for 24 hours. Plates for counting were incubated at 37° C. for 48 hours.

The culture for use in heat-resistance runs was grown on the surface of 225 cc of agar in a pyrex flask of the Roux type of 1,000-cc capacity. Each flask was inoculated with 3 cc of culture (about 2,000,000,000 to 3,000,000,000 organisms per cc) washed from a 24-hour slant with 5 cc of sterile water. The culture was incubated for 24 hours at 37° C. and was then washed off with 10 cc of sterile buffered distilled water, poured into a sterile egg-beater jar, beaten about 100 turns, and then filtered through a no. 14, 32-cm folded Whatman filter paper. Two flasks of culture suspended in one liter of water gave an average plate count per cc of 520,000,000. This suspension was used to contaminate the cans. The agar used for growing the culture and for plating was Difco dehydrated media, Standard Methods formula, pH 6.7.

*Buffering of the distilled water.*—The buffered distilled water used was prepared as follows:

(*a*) 39. 2 cc of m/15 dibasic potassium phosphate.
(*b*) 14. 5 cc of m/15 monobasic potassium phosphate.
(*c*) 946. 3 cc of distilled water
1, 000 cc—Total.

m/15 solution of dibasic potassium phosphate contains 11.62 grams per liter.

m/15 solution of monobasic potassium phosphate contains 9.06 grams per liter.

Merck's blue label phosphates were used.

The distilled water was obtained by condensing steam on the inside of a tubular milk cooler.

*Testing procedure.*—The following procedure was used in conducting the tests:

(1) Nine 10-gallon cans and covers were thoroughly washed, placed in the cabinet, and heated to a sufficient temperature and for a sufficient length of time to insure practical sterility. The cans used were in good condition, free from rust and excessive rough spots. This was

considered important, as otherwise it would be difficult to standardize the amount of the culture which would adhere to the cans.

(2) After cooling, two of the cans were each rinsed with 500 cc of sterile water to determine their bacterial count before inoculation with the test organism, thus affording a control.

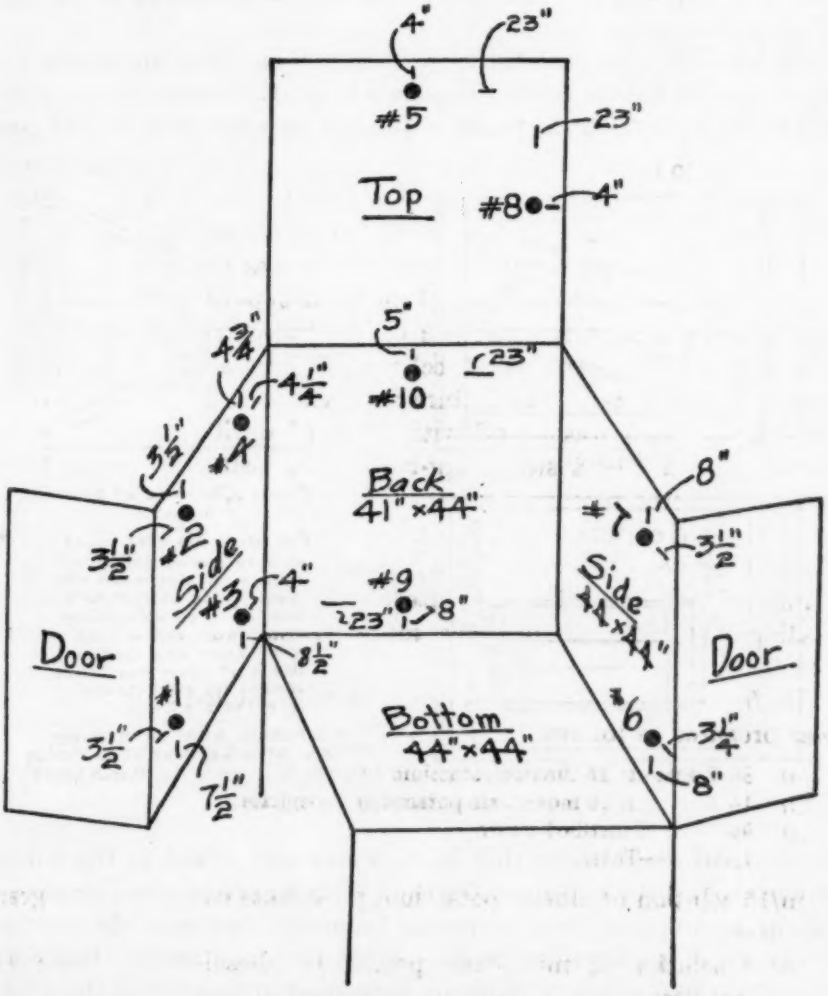



FIGURE 4.—Thermometer locations.

(3) All of the cans were then inoculated by rinsing them thoroughly with 1,000 cc of a water suspension of the test organism, prepared as previously described. This concentration was found necessary in order that there might remain a measurable final count after heat treatment, as otherwise the time and temperature combinations at which the assumed standard of 99.99 percent reduction was achieved could not be computed.

(4) The inoculated cans were inverted on a rack and allowed to drain for about 10 minutes.

(5) After draining, 1 or 2 of the inoculated cans were each rinsed with 500 cc of sterile water to determine the average initial contamination. The rinsing was done by means of a mechanical shaker. The shaking action was standardized at 100 revolutions made at the rate of 1 per second.

(6) All of the cans with their covers were then placed in an inverted position in the hot-air cabinet as shown in fig. 1. Except for the moisture in the culture on the inside of the can no water was used in con-

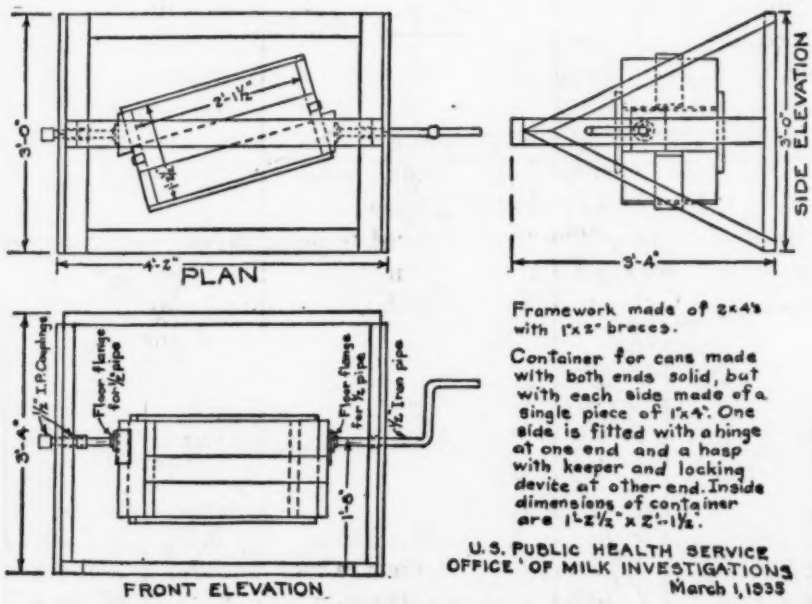



FIGURE 5.—Mechanical shaker for milk cans.

nection with these tests; that is, no water was placed in the hot-air cabinet nor on the outside of the can. This was considered important on the assumption that increasing humidity decreases the thermal resistance of an organism for any given time and temperature combination. Had auxiliary moisture been used in these tests the necessary time and temperature combination thus determined would not have been applicable to the use of cabinets in which water was not introduced and it is believed that many such cases will arise in the wide commercial use of hot-air cabinets.

(7) The cabinet was then heated to approximately the test temperature. The heat source intensity used was one which would give a heating period of approximately 30 minutes, the range actually being 26 to 39 minutes. A holding period of 10 minutes was used at all temperatures tested.

Immediately at the end of the holding period the cans were removed from the cabinet and allowed to cool for 30 minutes at atmospheric temperature.

(8) After cooling, each of the inoculated cans was rinsed with 500 cc of sterile water by means of the previously described shaker in order to determine the percentage reduction of the test organism which had resulted from the heat treatment.

## RESULTS

*Number of runs.*—Twenty runs were made in all, 5 at each of 4 test temperature groups.

*Initial contamination.*—The initial contamination varied from 18,000 per cc of can capacity to 70,000. The mean initial contamination for each of the 4 temperature groups varied from 42,000 per cc of can capacity for the 173.4° F. and the 184.7° F. temperature groups to 51,000 for the 163.5° temperature group. It was attempted to hold the variations down as far as possible, since extreme variations of the initial contamination would affect the results.

*Heating period.*—The time required to bring the cabinet to the test temperature varied from 26 to 39 minutes. The mean heating time for the various temperature groups, however, varied only from 28 minutes and 24 seconds for the 173.4° F. group to 34 minutes and 39 seconds for the 184.7° group. It was attempted to hold down as far as possible the variations in heating time, since the heating period obviously contributes to the total lethal effect and great differences in heating time would affect the results.

*Mean temperatures during holding period.*—The mean temperatures for the four temperature groups were 154.5° F., 163.5° F., 173.4° F., and 184.7° F. These four temperature groups were obtained by so operating the cabinet that the thermometer at the coldest point showed at least 150°, 160°, 170°, and 180° F., respectively.

*Temperature deviations during the holding period.*—The maximum deviation from the mean temperature at the start of the holding period varied from 1.5° F. to 26° F.

The maximum deviation from the mean temperature at the end of the holding period varied from 1° F. to 8° F.

In order to give a better indication of the true degree of dispersion of the temperature during the holding period, there was computed for each run and for each group of runs the probable error of the individual temperatures. The probable error ranged from ±2.6° F. for the 173.4° group of runs to ±3.6° F. for the 154.5° group of runs. This indicates that most of the temperatures throughout each of the 4 groups of runs were relatively close to the mean for the group.

*Bactericidal effect.*—The mean bactericidal reduction for the 4 groups ranged from 99.9372 percent at 154.5° F. to 99.9987 percent at

184.7° F. The mean residual count varied from 30 per cc of can capacity at a mean temperature of 154.5° F. to 0.57 per cc of can capacity at a mean temperature of 184.7° F.

These residual counts should not be compared with the residual total counts remaining from the commercial washing and sterilizing of cans.

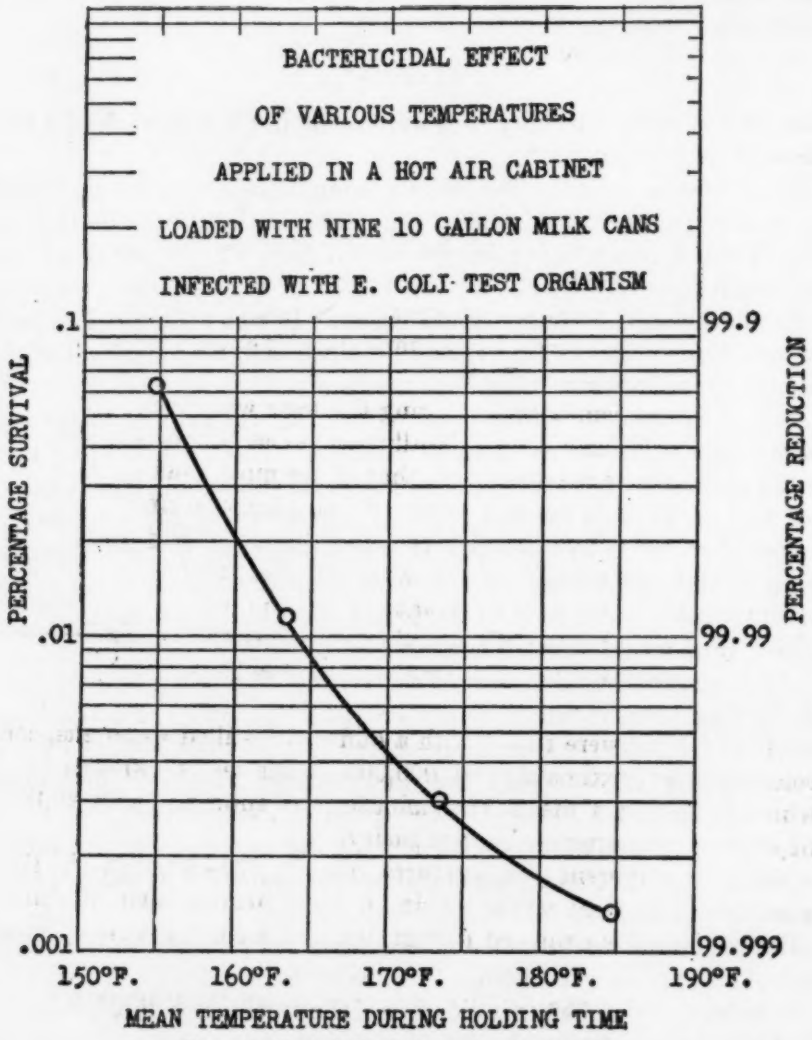



FIGURE 6.—Bactericidal effect of various temperatures.

Such cans are contaminated with an indefinite "run of the mill" flora of highly fluctuating thermal resistance, whereas the present work was done with a pure culture selected specifically for its heat resistance.

Nor should the residual counts determined in these tests be compared with the present standard of 1 per cc capacity recommended by the United States Public Health Service Milk Code as a criterion for

washing and sterilization. In the present experimental work the cans were not washed between contamination and bactericidal treatment. Had they been washed after contamination the count would obviously have been much lower. For reasons given earlier in this report, it is not considered that residual counts from "run of the mill" flora offer a dependable criterion of bactericidal treatment.

The mean percentages of bacterial reduction observed in these runs have been plotted against the mean temperatures for each of the four temperature groups on the accompanying graph. It will be observed that the points form a smooth curve and that the curve passes through the 99.99 percent reduction level at 164° F.

## SUMMARY AND CONCLUSIONS

(1) Studies were made of a 46-cubic foot hot-air cabinet, equipped with 2 gasoline burners and a 16-inch fan, and loaded with 9 milk cans, to determine the time and temperature necessary to produce satisfactory bactericidal treatment of milk cans by means of hot air which has not been humidified.

(2) The organism used in making the tests was a pure culture of a strain of *E. coli* isolated specifically for use as a test organism. Its thermal resistance is higher than that of the most heat-resistant milk-borne pathogen. In milk at 140° F. an exposure of 51 minutes is required to devitalize it, whereas practically all authorities agree that in milk at this temperature a 30-minute exposure is sufficient to devitalize the most heat-resistant milk-borne pathogen. When cultured as previously described and then suspended in distilled water buffered at pH 7.2 with phosphate buffers, a 99.99 percent reduction of the criterion organism was obtained in about 33 minutes at 140° F.

(3) The cans were rinsed with a buffered distilled water suspension containing approximately 500,000,000 of the test organisms per cc, which produced a mean contamination of approximately 40,000 to 50,000 organisms per cc of can capacity.

(4) Four different temperatures, namely, 154.5°, 163.5°, 173.4°, and 184.7° F., were studied, using a mean heating time of about 30 minutes, a holding time of 10 minutes, and a cooling time of 30 minutes.

(5) The use of the fan kept the deviations in temperature in the cabinet within a probable error of about 3° F.

(6) Under the above conditions a percentage killing of 99.99 percent was produced at 164° F.

(7) It is concluded that if hot air cabinets are operated so that the coldest portion remains at at least 180° F. for at least 20 minutes milk cans contained therein will be subjected to adequate bactericidal treatment.

(8) Such a time and temperature combination would provide at least a 16° F. plus a 10 minute margin of safety.

REFERENCES

(*1*) Park, W. H.: Thermal death points of pathogenic bacteria in milk. Am. J. Pub. Health, *17*: 36 (January 1927).
(*2*) Park, W. H.: Thermal death point of streptococci. Am. J. Pub. Health, *17*: 710 (June 1928).

## TOXICOLOGY OF PHENYLDICHLORARSINE

### I. EXPERIMENTS WITH ANIMALS[1]

By H. C. Dudley, *Associate Biochemist*, and B. F. Jones, *Passed Assistant Surgeon, United States Public Health Service*

The use of phenyldichlorarsine (commonly abbreviated PDA) approximately 1 percent by weight in medium and heavy petroleum distillates, as a wood preservative has undergone laboratory and general service tests. Experimental studies indicate that mixtures of this type are efficient wood preservatives because of the fungicidal properties of the arsenical compounds present (*1*, *2*, *3*). The introduction of PDA-oil mixtures in processes or adaptations of processes commonly employed in wood preservation will create many possibilities of personal contact with these materials.

The purpose of this series of papers is to show the effects of exposure to phenyldichlorarsine (*a*) in the vapor phase, (*b*) in the liquid phase, and (*c*) when mixed with certain petroleum oils. The part of the investigation reported at this time deals with the response of experimental animals to exposure of PDA in various ways and circumstances.

Because of its toxic properties, PDA was used as a chemical agent during the World War, but never to any great extent. For the most part, PDA was used as an artillery shell filling, admixed with other agents (*4*). Certain studies made of the toxic and vesicant properties of PDA by the Chemical Warfare Service, United States Army, have been reported by Hanzlik and Tarr (*5*). These authors class PDA as a severe irritant which produced hyperemia, swelling, and edema, ulceration, necrosis, and similar conditions, on dog's skin, together with vesication on human skin. They draw the following conclusions as the result of their investigations:

> As a rule the active arsenicals acted more severely than dichlordiethyl sulfide (mustard gas) during the acute stages. The lesions were more pronounced, painful, indurated, and attached. The ulcers were sharply punched out, clean, dry, and possessed red bases. Healing occurred promptly. The differences between the different arsenicals were principally quantitative. The order of skin irritant efficiency, in descending order, is dichlordiethyl sulfide (mustard gas), phenyldichlorarsine (PDA), and methyl dichlorarsine. The arsenicals are efficient

[1] From the Division of Industrial Hygiene, National Institute of Health.

protein precipitants, unlike dichlordiethyl sulfide, indicating a different type of reaction. The arsenicals produce a deep brown pigmentation of the affected areas.

Flury (*11*) places the intolerable concentration for man, i. e., that concentration in which it is impossible to remain for more than 1 minute, at 10 cubic millimeters of liquid PDA per cubic meter, corresponding to 0.0164 mg per liter of air. The same author gives 1:500,000 in water as a lethal concentration of PDA for fish (bitterling and minnows) and a concentration of 1:50,000 as lethal to trypanosomes at 37° C. Other related organic arsenic compounds were found to be highly toxic to insects, paramecia, and even to plants.

Phenyldichlorarsine, PDA, $C_6H_5$–As–$Cl_2$, when pure, is an oily liquid of low viscosity, colorless to pale straw color; molecular weight, 222.9; soluble in ether, alcohol, acetone, and petroleum distillates; very slightly soluble in water; vapor pressure, 0.035 mm Hg at 25° C.; boiling point, 255°–257° C.; specific gravity, 1.64; vapor density, 7.75; saturated concentration in air at 20° C., 404 mg/$m^3$; intolerable concentration, 16 mg/$m^3$; is stable in presence of oxygen (*4*, *7*, *8*, *9*). There seems to be some disagreement among certain authors as to the rapidity and the products of hydrolysis. Roeder and Blasi (*6*) state that PDA hydrolyzes to phenyl arsonic acid, $C_6H_5$–AsO $(OH)_2$. Hanslian (*4*) indicates that decomposition occurs in water and that the products of decomposition are toxic. In a review of organic arsenicals, Raiziss and Gavron (*10*, p. 115) state that PDA is unaffected by hot or cold water. Additional investigation seems necessary to clear up this point of importance in relation to the effects of weathering on wood products treated with the PDA-oil mixtures.

### A. INHALATION TESTS

#### 1. PDA VAPOR

A small constant-flow chamber set-up was used to expose guinea pigs for 10 and 30 minutes to various PDA-air mixtures, in concentrations ranging from 0.10 mg PDA/liter to 0.40 mg PDA/liter. The air-PDA vapor mixture of various concentrations was prepared by passing a stream of air through bubblers containing liquid PDA. The air stream saturated with PDA vapor was then mixed in varying proportions with a stream of fresh air and led into the chamber. Samples were drawn from the chamber by means of a calibrated flowmeter. The PDA in the air sample was absorbed in soda lime tubes, the contents of these tubes were dissolved in hydrochloric acid, and the quantity of PDA present was estimated from an aliquot sample by means of the modified Gutzeit method. Standards were prepared as described later under a description of vapor tests with PDA-oil mixtures.

Exposures of guinea pigs were made to a graded series of PDA-air

mixtures. Ten guinea pigs at a time were exposed to each concentration. The animals were observed during the experiment and for a period of 20 days following exposure for the effects of the PDA. Symptoms were noted and deaths were tabulated by 24-hour intervals.

Analysis of the phenyldichlorarsine used in this series of experiments showed As 32.88 percent, Cl 31.18 percent. Although this analysis indicates a purity of 98 percent, the probable presence of $AsCl_3$ as a contaminant makes this analysis misleading. By means of fractional distillation, the purity of the sample was estimated at 93 to 95 percent PDA.

In table 1 are shown the results of the exposure of guinea pigs to vapors of PDA in concentrations of 0.10 to 0.40 mg PDA/liter, for 10 and 30 minutes. These results indicated that PDA vapor is but slightly toxic for guinea pigs on short exposure, that is, for exposures of 10 minutes or less. For longer exposures the toxic action is more pronounced. In evaluating the toxicity data shown, it must be kept in mind that the vapors of PDA are extremely irritating. In all cases the eyes and nose of the animal gave evidence of severe irritation. This effect had cleared within 3 to 5 days.

TABLE 1.—*Mortality of guinea pigs exposed to PDA vapors*

| Concentration mg PDA per liter | Length of exposure (minutes) | Number of animals exposed | Deaths, in days | | | | Percent dying in 20 days |
|---|---|---|---|---|---|---|---|
| | | | 1 to 5 | 6 to 10 | 11 to 15 | 16 to 20 | |
| Controls | | 10 | 0 | 1 | 0 | 0 | 10 |
| 0.10 | 10 | 10 | 1 | 0 | 0 | 0 | 10 |
| .37 | 10 | 10 | 2 | 0 | 0 | 0 | 20 |
| .40 | 10 | 10 | 1 | 0 | 1 | 0 | 20 |
| .40 | 10 | 10 | 1 | 1 | 0 | 0 | 20 |
| .40 | 30 | 10 | 3 | 1 | 0 | 0 | 40 |

Prentiss (*9*, p. 165) states:

> While the primary physiological effect of phenyldichlorarsine on men and animals is injury to the lungs and death is usually caused by pulmonary edema, phenyldichlorarsine also has a marked vesicant as well as a sternutatory effect on the upper respiratory passages. Its toxicity exceeds that of phosgene, a concentration of 0.26 mg per liter being fatal in 10 minutes; its vesicant action is somewhat slower than that of mustard gas and the resulting wounds as a rule heal more rapidly.

Prentiss does not state the experimental basis for the minimum lethal concentration of 0.26 mg PDA/liter, nor what animals were used in the toxicity tests (presumably mice). From the results obtained by the present authors, and reported herein, it would appear that the lethal properties of PDA in the vapor phase have heretofore been somewhat overestimated. It is true, however, that the vapor is extremely irritating to the eyes and nasal passages.

2. PDA-OIL VAPORS

In order to determine the effect of oil-PDA vapors at room temperature, rabbits were exposed for 2- and 4-hour periods to the vapors derived from oil mixtures containing 1 percent PDA.

Three rabbits in each experiment were placed in mesh wire cages inside a cubical fiberboard chamber, volume 8 cubic feet, and a stream of the oil-PDA vapor was passed through the chamber at approximately 4 liters per minute. A small electric fan was placed in the chamber so as to give complete mixing of the vapor stream and the chamber atmosphere. The air stream before entering the chamber was bubbled through a large capacity bubbler containing 1 percent PDA-oil mixture. The bubbler was kept in a water bath, temperature 40°–50° C. On leaving the bubbler, the air stream passed through a water-cooled reflux condenser attached so as to return all condensate to the bubbler. The temperature of the air stream as it entered the chamber was 23°–25° C. By this procedure a saturated atmosphere, at room temperature, of the vapor was secured. Since there was no cooling effect inside the chamber, and the oil and PDA were in a true gaseous phase, no mist or fog was formed, nor was there any condensation on the cage or walls of the chamber.

In exposing the animals by the above procedure, it was possible to determine the effects of the greatest possible true gaseous concentration of PDA obtainable from oils of the character tested, at temperatures of 23°–25° C.

In order to determine analytically the concentration of PDA to which the animals had been exposed, the procedure described below was followed:

A metered flow of air was forced through the bubbler set-up, as previously described, at the rate of 3.82 liters per minute. The air stream was then cooled by the reflux condenser and passed into a soda-lime absorption tube. The amount of arsenic in this tube was determined by the modified Gutzeit method. Standards for comparison were prepared by absorbing weighed amounts of PDA in identical absorption tubes. Since the same lots of reagents in equal quantities were used in preparing the standards and in the analytical determination, no blank correction was needed.

The animals used were normal albino rabbits. A small area about 3 inches by 2 inches on the back of each animal was clipped free from hair. These areas were observed for any skin effects due to exposure to the oil-PDA vapor. The eyes and nostrils were examined in order to determine the effects of exposure on these organs.

In table 2 are shown the results of the oil-PDA vapor tests. These results indicate that saturated PDA-oil vapors arising from 1 percent PDA solutions at ordinary temperatures are but slightly irritant and

do not present a serious hazard on acute exposure. It must be pointed out, however, that supersaturated vapors will produce mists or fogs, which, on condensation, may produce the effects shown by skin and eye application of the PDA-oil mixtures.

TABLE 2.—*Effects of oil-PDA vapors on rabbits*

| Animal | Concentration PDA mg/l | Length of exposure | Symptoms |
|---|---|---|---|
| | | *Hours* | |
| **VAPORS FROM 1 PERCENT PDA IN OIL NO. 208** | | | |
| Rabbit No. 1 | 0.013 | 2 | Negative. |
| Rabbit No. 2 | .013 | 2 | Slight erythema of skin area immediately after test. No redness after 24 hours. Other symptoms negative. |
| Rabbit No. 3 | .013 | 2 | Negative. |
| Rabbit No. 4 | .013 | 4 | Slight erythema of skin area immediately after test. Slight conjunctivitis in 24 hours. Clear at 48 hours. |
| Rabbit No. 5 | .013 | 4 | Slight conjunctivitis in 24 hours. Clear at 48 hours. |
| Rabbit No. 6 | .013 | 4 | Do. |
| **VAPORS FROM 1-PERCENT PDA IN OIL NO. 1608** | | | |
| Rabbit No. 7 | 0.015 | 4 | Negative. |
| Rabbit No. 8 | .015 | 4 | Very slight conjunctivitis at end of 24 hours. Slight redness on skin area, 24 hours. Clear at end of 48 hours. |
| Rabbit No. 9 | .015 | 4 | Very slight conjunctivitis at end of 24 hours. Clear at end of 48 hours. |

NOTE.—No general systemic effects were noted in any of the animals exposed in the above tests. No deaths occurred as the result of these exposure tests. When rabbits were exposed for 4 hours to vapors of the oils (No. 208 and No. 1608) under the same conditions as that of the previous experiments, no eye or skin irritation was noted.

### B. APPLICATION OF LIQUID PDA TO THE SKIN

In order to determine the action of PDA when the undiluted material is applied to the skin, measured amounts of the liquid were applied to shaved areas on the backs of normal rabbits. The rabbits were placed in a stock which prevented the animal from contaminating the laboratory equipment and partially removing or spreading the PDA. After application of the PDA to the back of the rabbit, the animals were allowed to remain in the stocks for a period of 2 hours in order to allow time for absorption of the material. Animals were then placed in individual cages for observation. The amount of PDA applied to the rabbits was measured by means of calibrated capillary pipettes delivering 0.10 and 0.01 cc. The specific gravity of PDA, 1.64, was used in calculating the toxicity values expressed in milligrams of PDA per kilogram of body weight.

In table 3 are shown the results of toxicity tests made with measured quantities of liquid undiluted PDA when applied to clipped areas on the backs of normal rabbits.

On gross pathological examination of the animals which died in this series of experiments, the significant abnormalities noted were pulmonary congestion and, in some cases, marked lung edema with con-

siderable cardiac dilatation. The results of microscopic examination of tissues will be reported at a later date.

TABLE 3.—*Results of application of undiluted PDA to skin of rabbits*

| Weight of rabbit (grams) | PDA applied | Mg PDA per kilo [1] | Results | Weight of rabbit (grams) | PDA applied | Mg PDA per kilo [1] | Results |
|---|---|---|---|---|---|---|---|
| | *Cc* | | | | *Cc* | | |
| 2,408 | 0.15 | 102 | Dead in 3½ hours. | 2,793 | .02 | 11.7 | Dead in 3 days. |
| 2,347 | .10 | 70 | Dead in 3 hours. | 2,856 | .02 | 11.4 | Dead in 2 days. |
| 3,181 | .10 | 51 | Do. | 1,484 | .01 | 11.0 | Dead in 4 days. |
| 2,232 | .05 | 37 | Dead in 15 hours. | 3,043 | .02 | 10.7 | Dead in 10 days. |
| 2,215 | .04 | 29.6 | Dead in 20 hours. | 3,108 | .02 | 10.5 | Survived, severe burn. |
| 2,533 | .03 | 19.4 | Dead in 2 days. | 3,341 | .02 | 9.8 | Dead in 3 days. |
| 1,913 | .02 | 17.1 | Do. | 1,788 | .01 | 9.2 | Dead in 2 days. |
| 3,424 | .03 | 14.4 | Dead in 20 hours. | 1,836 | .01 | 8.9 | Survived, severe burn. |
| 1,185 | .01 | 13.8 | Dead in 3 days. | 3,750 | .02 | 8.7 | Dead in 20 hours. |
| 1,388 | .01 | 11.9 | Dead in 2 days. | 2,814 | .01 | 5.8 | Survived, severe burn. |

[1] Calculated from density, 1.64.

The course of the burns resulting from the skin applications as shown in table 3 may be summarized in the following manner:

| | |
|---|---|
| 15 minutes after application | Blanching at site of application. Erythema in surrounding area. |
| 1 hour after application | Wheal around depressed site of application. |
| 2 hours after application | General swelling. Central lesion, flat, depressed; "punched out." |
| 24 hours after application | General severe swelling and edema. |
| 48 hours after application | Swelling subsiding. No exudate. |
| 5 days after application | Swelling subsided. Area of original swelling colored yellow. Area of application very dry and hard. |
| 10 days after application | Healing well progressed. Entire area yellowish and central area very hard. Firmly attached. |
| 20 days after application | Do. |
| 30 days after application | Do. |

### C. VESICANT PROPERTIES OF PDA IN OIL MIXTURES

The oils used for these tests were petroleum distillates. Oil No. 208, a gas oil, flash point (open cup), 150° F.; Robinson color No. 8; Saybolt universal viscosity at 100° F., 35–45; final boiling point, 725° F.

Oil No. 1608, a fuel oil, flash point (open cup), 325–340° F.; gravity (A. P. I.), 19.5–21.5; Robinson color, black; Saybolt universal viscosity at 100° F., 700–725, at 210° F., 60–65.

Solutions of PDA, 0.01 percent, 0.1 percent, and 1 percent by weight in each oil were made by adding measured amounts of PDA to known weights of the oil.

The shaved belly of the rabbit on test was marked off in eight equal squares, using an indelible pencil to define the areas. To each of these

areas a small drop of the oil or oil-PDA mixture under test (approximately 0.02 cc) was applied. Two areas were then treated with the 0.01 percent of PDA-oil mixture. In the same manner, the 0.1 percent and 1 percent of PDA-oil mixtures were applied. The animals being held were allowed to remain in this position for 1 hour to allow the oil to spread and prevent excessive loss when replacing the rabbit in the cages. In order to prevent contamination of each other, the animals were placed in separate cages. Two rabbits were used for each type of oil, making a total of four areas tested for each oil-PDA combination and concentration. The effects of the oils and oil-PDA mixtures were noted daily.

In table 4 are shown the results of vesicant tests using PDA-oil mixtures containing 0.01 percent, 0.1 percent, and 1 percent PDA. These results show conclusively that 1 percent PDA mixtures with oils of this type are powerful vesicants for rabbits.

TABLE 4.—*Vesicant action of 0.02 cc oil-PDA mixtures when applied to shaved belly of rabbit*

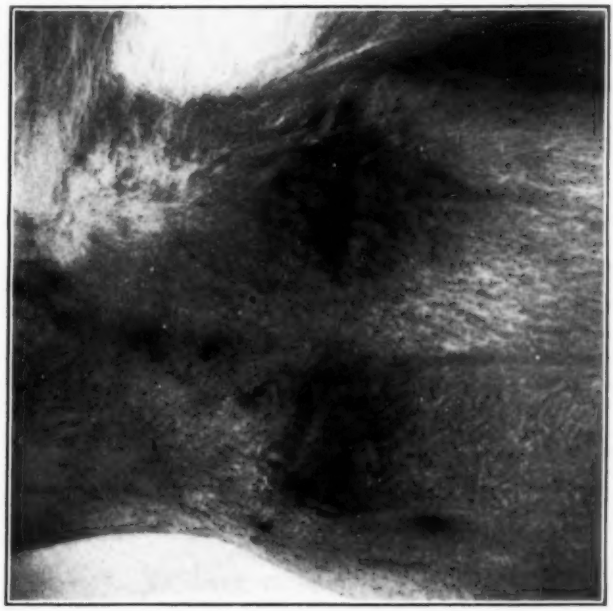
| Subject | Percent PDA in mixture | Observations after application | | | |
|---|---|---|---|---|---|
| | | 24 hours | 48 hours | 72 hours | 96 hours |
| | | OIL NO. 208+PDA | | | |
| Rabbit No. 1. | 1.0 | Induration with definite scab formation. | Scab formation unchanged, a large white area of swelling and induration surrounding scab. | Area slowly healing, swelling less. Thin scab formation. | Swelling subsided; scab formation over entire area of swelling. |
| | .1 | (1) | (1) | (1) | (1). |
| | .01 | (1) | (1) | (1) | (1). |
| Rabbit No. 2. | 1.0 | Induration of skin... | Blanched area, with swelling. | Slight swelling with scab formation. | No swelling, with thick scab formation. |
| | .1 | (1) | (1) | (1) | (1). |
| | .01 | (1) | (1) | (1) | (1). |
| | | OIL NO. 1608+PDA | | | |
| Rabbit No. 3. | 1.0 | Hardening and thickening of skin. | Large thin scab, with swelling. | Swelling subsiding, thick scab. | Same as third day. |
| | .1 | (1) | (1) | (1) | (1). |
| | .01 | (1) | (1) | (1) | (1). |
| Rabbit No. 4. | 1.0 | Induration with definite scab formation. | Marked swelling, with thick scab. | General healing; heavy scab, swelling subsiding. | Same as third day. |
| | .1 | (1) | (1) | (1) | (1). |
| | .01 | (1) | (1) | (1) | (1). |

[1] No reaction.

Healing of the affected areas began after the third day and was complete in 20-25 days. No systemic effects were noted. In no case did open ulcers or slough occur; scab formation followed gradual weeping of affected areas. As healing progressed the areas of application became indurated and adherent to the subcutaneous tissue.

Note photographs taken on fifth day after application 1 percent PDA in oil; rabbits Nos. 1 and 4.

On a second series of skin tests with rabbits, the 1-percent PDA-oil mixtures gave results identical with those shown in table 4. Controls



Rabbit No. 1.—1.0 percent PDA in oil No. 208. Scab formation 5 days after application on clipped belly of rabbit. (Approx. × 1.)

Rabbit No. 4.—1.0 percent PDA in oil No. 1608. Scab formation 4 days after application on clipped belly of rabbit. (Approx. × 1.)

of coal-tar creosote were used in order to show the relative irritant qualities of the creosote and oil-PDA mixtures. The creosote, on skin application to rabbits, gave slight irritation which cleared in 48 hours.

Vesicant tests were made with commercially prepared PDA-oil mixtures containing 0.06 pound PDA per gallon (approximately 0.75 percent by weight PDA). Rabbits were used for these tests as described above. The commercially-prepared oil mixtures, made from oil No. 208 and oil No. 1608, showed vesicant properties practically identical to the mixtures prepared in this laboratory, containing 1 percent by weight PDA. Commercial oil mixtures which had been used in wood-treating processes (hot pressure process) produced the same skin reactions as the unused commercial mixtures.

Wood samples treated with the commercially prepared oil mixtures were examined and tested. The wood samples treated with the PDA in gas oil (No. 208) had no excess oil remaining on the surface of the wood. In the case of the wood samples treated with the fuel oil mixture (No. 1608), a rather large amount of the oil mixture adhered to the surface of the wood. When this oil was scraped off and applied to the skin of rabbits, burns resulted very similar to those described previously for the 1-percent PDA in oil No. 1608. (See table 4.) Wood samples treated with PDA fuel-oil mixtures were allowed to weather for 3 weeks on the roof of a building. The excess surface oil obtained from these samples when applied to the skin of rabbits produced but slight irritation.

The fuel oil (No. 1608) used in making PDA-fuel oil mixtures is of such high viscosity that a considerable excess of the mixture remains on the surface of treated wood after drainage. In the case of the gas oil (No. 208), the viscosity at ordinary temperatures is such that complete surface drainage is accomplished.

Wood chips, free from adhering surface oil, were cut from the weathered and unweathered wood samples and taped to clipped areas on the backs of albino rabbits. Although these wood chips were well impregnated by the oil mixtures, no skin irritation resulted from this treatment after the wood had been in close contact with the skin for 4 hours.

In order to determine the further effects of PDA in the oil mixtures, the eyes of rabbits were treated with 0.5 percent PDA-oil mixtures. As a control, to the right eyeball of the rabbit 0.02 cc of the oil was applied. To the left eyeball, 0.02 cc of the 0.5 percent PDA-oil mixture was applied. The effects were noted as to severity and duration.

In table 5 are shown the results of vesicant tests obtained when 0.5 percent PDA-oil mixtures were applied to the eyes of rabbits.

These results show that a concentration of 0.5 percent by weight PDA in mineral oils is extremely irritating to the eyes of rabbits.

TABLE 5.—*Action of 0.5 percent PDA in oil when applied to eye of rabbit—(0.02 cc applied to eyeball)*

| Oil | Subject | Eye | Observations after application | | | | |
|---|---|---|---|---|---|---|---|
| | | | 24 hours | 48 hours | 72 hours | 96 hours | 120 hours |
| Oil No. 208. | Rabbit No. 5. | Right; oil No. 208. | [1] | [1] | [1] | [1] | [1]. |
| | | Left; oil plus 0.5 percent PDA. | Swelling, acute conjunctivitis. | No swelling, slight conjunctivitis. | No conjunctivitis. Eye clear. | Normal | Normal. |
| Oil No. 1608. | Rabbit No. 6. | Right; oil No. 1608. | [1] | [1] | [1] | [1] | [1]. |
| | | Left; oil plus 0.5 percent PDA. | Swelling, acute conjunctivitis. | Same as at 24 hours. | Swelling subsided, acute conjunctivitis. | Same as at 72 hours. | Same as at 96 hours. |

[1] No reaction.

NOTE.—Rabbit No. 6 suffered secondary infection in the eye treated with the PDA-oil mixture, with death resulting 15 days after treatment.

## DISCUSSION

Flury and his collaborators (*11*) investigated several hundred organic arsenical compounds, including PDA and diphenylchloroarsine (DA). From their work it is obvious that these compounds are powerful general protoplasmic poisons whose systemic and local actions as a group are similar. Flury traces the toxic action to destruction of enzymes, particularly catalase and the oxidative enzymes of the cell. He attributes the local irritant action to the production of arsenious acid and its prolongation to the splitting off of arsenic. This effect is considered to be specific and not due to change in pH from appearance of acid ions.

It is interesting to note that this author reports the development of lung edema in cats after subcutaneous injection of 1 mg per kilo body weight of diphenylchloroarsine under circumstances precluding the possibility of inhalation of vapor. This agrees with our own experience in some cases when PDA was applied in minimal lethal dosage to the skin of rabbits without possibility of inhalation of vapor. Further experiments to test the influence of the vagus in the production of this edema are needed. Flury attributes the edema to injury to the capillaries of the lungs rather than to general circulatory failure.

## SUMMARY

The projected use of phenyldichlorarsine (PDA), approximately 1 percent by weight, in medium and heavy petroleum distillates, as wood preservative mixtures, necessitates studies on the toxic and vesicant action of phenyldichlorarsine.

The minimum lethal concentration of PDA for guinea pigs, 10- to 30-minute exposure, is greater than 0.40 mg/liter, the saturation concentration at 25° C. Liquid PDA produces intense and fatal burns on normal rabbits when applied to the skin in amounts less than 0.02 cc. Calculated on a weight basis, the minimum lethal dose for rabbits, by skin application is 8–10 mg per kilogram of body weight.

When PDA is mixed with medium and heavy petroleum distillates in concentrations of 1 percent by weight, the resulting mixture is extremely vesicant and approximately 0.02 cc will produce burns on rabbits. In general, the heavy, more viscous oil produced the more severe burns. The heavy oil tended to localize the burn, giving a small but more severe reaction. The lighter oil gave a burn of less intensity but covering a greater area.

Excess oil remaining on the surface of wood samples freshly treated with PDA-oil mixtures produced marked irritation when applied to the skin of rabbits. Weathering of such treated wood samples for 3 weeks greatly reduced the irritating action of the surface oil.

When well-impregnated wood samples, wiped free from excess surface oil, were placed in contact with the skin of rabbits for 4 hours, no irritation resulted.

The experiments reported in this paper deal only with the effects of acute exposure to PDA. In addition to acute effects, the possibility of chronic intoxication from the original irritant material, arsenic, and other arsenic derivatives must be considered.

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# A MODIFIED CELL FOR DUST COUNTING

By CHARLES E. COUCHMAN, *Inspector of Industrial Hygiene*, and WILMER H. SCHULZE, *Director of the Bureau of Environmental Hygiene, Baltimore City Health Department*

The Greenburg-Smith impinger (*1*) and Sedgwick-Rafter counting cells are generally recognized as standard equipment for evaluating the extent of dust exposures in industrial occupations. While the basic principles of the impinger have remained unchanged, several modifications have served to provide an apparatus of more rugged character and, hence, more adaptable to general field use. The Sedgwick-Rafter counting cell is used for the quantification of the dust collected with the impinger equipment. This cell, originally designed for making microscopical studies of water supplies, has certain disadvantages when used for studying industrial dusts. From our experience these may be enumerated as follows:

1. The edges and corners formed by the cell walls make it difficult to remove all dust particles during cleaning.

2. Through usage the bottom of the cell may become scratched to the extent that it interferes with the accurate counting of dust particles.

3. A water-alcohol mixture, used for the collection of types of dust which tend to clump in water alone (*2*), acts as a solvent on the cement which holds the cell walls in place, thus necessitating recementing or replacement.

4. Recementing the cell walls may entail an appreciable error in the depth of the cell, hence a resultant error in the dust count. Although this discrepancy may be of little significance in comparison with others introduced in the sampling technique, its elimination does improve the accuracy of the procedure.

5. The solvent effect on the cement of oils used as media for comparing the refractive indices of dust particles makes it impractical to use the Sedgwick-Rafter cell for this purpose (*3*).

6. The amount of breakage of cells is increased by its all-glass construction.

The extensive use of dust-counting cells in the field of industrial hygiene led to the construction of a cell which eliminates the disadvantages entailed in the Sedgwick-Rafter unit. Figure 1 is a photograph of an assembled modified cell which we have found to equal in accuracy the Sedgwick-Rafter cell and to offer distinct advantages over the latter unit. A circular glass disk is held between two threaded circular metal frames. The upper frame has a central circular opening $1\frac{13}{32}$ inches (35.6 mm) in diameter and is machined to 0.039 inch (1 mm) thickness. The accuracy of the cell is dependent upon the latter dimension, and this is the only measurement of prime importance.

FIGURE 1.—Assembled modified cell.

The other dimensions given in the cross-section view of the cell in figure 2 need only be approximate.

The circular glass disks, one being used as a cover glass for the cell and one serving as the bottom of the cell, should be of good optical quality, equal to that used by goggle manufacturers. We have found goggle disks, free from distortion and scratches, to answer the purpose very satisfactorily. Disks with parallel surfaces must be used, since curved surfaces will vary the required 1 mm depth throughout the cell. Table 1 shows the comparison of the depths of several Sedgwick-Rafter cells with the modified cell in which goggle disks from two manufacturers were used. Columns 4 and 5 show the errors which may result in recementing the walls of Sedgwick-Rafter cells in the laboratory. It is apparent that the accuracy in the depth of the modified cell is equivalent to those of the Sedgwick-Rafter cells into which no error has been introduced by recementing. Measurements were made with a micrometer depth gage graduated into thousandths

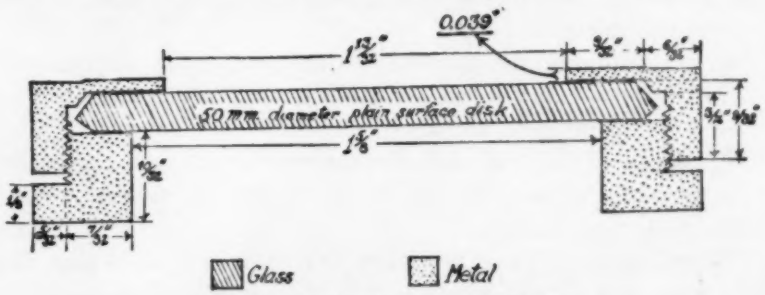


FIGURE 2.—Cross-section of circular dust cell.

of an inch and estimated to the quarter of a thousandth. Similar results of depth measurements in Sedgwick-Rafter cells, both new and recemented, were obtained by an interested worker in another laboratory.

TABLE 1.—*Measurement of depths of dust-counting cells*

(1 mm = 0.03937 inch)

| | Sedgwick-Rafter cells | | | | | Modified cell goggle disks | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4[1] | 5[1] | 6 | 7 |
| Average of 10 readings (in thousandths of an inch) | 39.73 | 39.50 | 39.40 | 36.80 | 38.18 | 39.55 | 39.40 |
| Percent error | +0.9 | +0.3 | 0 | −6.3 | −3.0 | +0.5 | 0 |
| Greatest deviation | 0.75 | 0.50 | 0.50 | 5.25 | 5.50 | 0.50 | 0.75 |

[1] Cell walls had been recemented in the laboratory.

In order to make comparative dust counts, using the Sedgwick-Rafter cell and the modified cell, 10 samples of various types of industrial dusts were collected with the impinger and quantification of the

dust was carried out according to the present standard procedure (*4*). The average dust counts of five fields per sample are given in table 2. The data indicate the accuracy with which dust counts can be made by substituting the modified cell for the Sedgwick-Rafter counting cell.

TABLE 2.—*Comparative dust counts—Average count of 5 fields*

| Sample No. | Sedgwick-Rafter cell | Modified cell | Sample No. | Sedgwick-Rafter cell | Modified cell |
|---|---|---|---|---|---|
| 1 | 90 | 88 | 6 | 76 | 80 |
| 2 | 37 | 35 | 7 | 38 | 38 |
| 3 | 44 | 45 | 8 | 127 | 130 |
| 4 | 60 | 59 | 9 | 130 | 133 |
| 5 | 46 | 47 | 10 | 70 | 68 |

## SUMMARY

A modified dust-counting cell has been constructed and described which has the following advantages over the Sedgwick-Rafter counting cell now generally used in the quantification of dust samples collected by the impinger method:

1. Any type of liquid media used for dust suspensions for quantification or for refractive indices observations may be used in the cell without subsequent damage to the cell.

2. The depth of the cell will remain constant, since there are no cemented parts. (Unnecessarily rough treatment might cause the 1-mm rim to become flanged.)

3. The cell, being of circular design, is free from corners and, hence, easy to clean. (Fair recommends this change of design in the Sedgwick-Rafter counting cell (*5*).)

4. In the event the lower disk becomes scratched, replacement can be made at very little cost.

5. The modified cell, being of more rugged construction than the Sedgwick-Rafter cell, is less subject to damage.

6. Cleaning is easily accomplished by taking the cell apart and immersing the lower lense in chromic acid cleaning solution.

7. The cost of the cell compares favorably with that of the Sedgwick-Rafter cell and there is less chance of breakage and need for replacement.

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# DEATHS DURING WEEK ENDED FEBRUARY 12, 1938

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

| | Week ended Feb. 12, 1938 | Corresponding week, 1937 |
|---|---|---|
| Data from 86 large cities of the United States: | | |
| Total deaths | 8,795 | [1] 10,452 |
| Average for 3 prior years | 9,812 | |
| Total deaths, first 6 weeks of year | 54,514 | 65,052 |
| Deaths under 1 year of age | 527 | [1] 616 |
| Average for 3 prior years | 619 | |
| Deaths under 1 year of age, first 6 weeks of year | 3,224 | 3,883 |
| Data from industrial insurance companies: | | |
| Policies in force | 69,795,000 | 69,161,259 |
| Number of death claims | 13,550 | 13,490 |
| Death claims per 1,000 policies in force, annual rate | 10.1 | 10.2 |
| Death claims per 1,000 policies, first 6 weeks of year, annual rate | 10.0 | 11.5 |

[1] Data for 85 cities.

# PREVALENCE OF DISEASE

*No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring*

## UNITED STATES

### CURRENT WEEKLY STATE REPORTS

These reports are preliminary, and the figures are subject to change when later returns are received by the State health officers.

In these and the following tables a zero (0) is to be interpreted to mean that no cases or deaths occurred, while leaders (------) indicate that cases or deaths may have occurred although none were reported.

*Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Feb. 19, 1938, and Feb. 20, 1937*

| Division and State | Diphtheria | | Influenza | | Measles | | Meningococcus meningitis | |
|---|---|---|---|---|---|---|---|---|
| | Week ended Feb. 19, 1938 | Week ended Feb. 20, 1937 | Week ended Feb. 19, 1938 | Week ended Feb. 20, 1937 | Week ended Feb. 19, 1938 | Week ended Feb. 20, 1937 | Week ended Feb. 19, 1938 | Week ended Feb. 20, 1937 |
| New England States: | | | | | | | | |
| Maine | 1 | ------ | 13 | 512 | 87 | 5 | 0 | 0 |
| New Hampshire | 1 | ------ | 2 | ------ | 45 | 20 | 0 | 0 |
| Vermont | 1 | ------ | ------ | ------ | 163 | 2 | 0 | 0 |
| Massachusetts | 7 | 8 | ------ | ------ | 209 | 833 | 2 | 6 |
| Rhode Island | ------ | 1 | ------ | 14 | 1 | 205 | 0 | 1 |
| Connecticut | 7 | 5 | 10 | 354 | 10 | 568 | 0 | 1 |
| Middle Atlantic States: | | | | | | | | |
| New York [1] | 35 | 51 | [1] 24 | [1] 74 | [1] 1,290 | 402 | 9 | 18 |
| New Jersey | 26 | 6 | 23 | 110 | 1,595 | 1,251 | 3 | 7 |
| Pennsylvania | 33 | 46 | ------ | ------ | 6,972 | 204 | 4 | 9 |
| East North Central States: | | | | | | | | |
| Ohio | 19 | 20 | ------ | 270 | 1,344 | 54 | 4 | 9 |
| Indiana | 45 | 6 | 22 | 220 | 455 | 12 | 0 | 3 |
| Illinois | 38 | 31 | 24 | 131 | 6,278 | 26 | 0 | 8 |
| Michigan [2] | 10 | 32 | 3 | 12 | 2,284 | 56 | 4 | 4 |
| Wisconsin | 6 | 1 | 70 | 308 | 3,137 | 14 | 1 | 0 |
| West North Central States: | | | | | | | | |
| Minnesota | 2 | 3 | 3 | 4 | 85 | 18 | 0 | 3 |
| Iowa | 8 | 5 | 15 | 64 | 100 | 4 | 2 | 2 |
| Missouri | 8 | 12 | 153 | 1,565 | 1,183 | 9 | 1 | 2 |
| North Dakota | ------ | 2 | ------ | 41 | 15 | 2 | 0 | 1 |
| South Dakota | ------ | 1 | ------ | 11 | ------ | 2 | 0 | 3 |
| Nebraska | 14 | ------ | 9 | 15 | 16 | 1 | 1 | 1 |
| Kansas | 5 | 8 | 2 | 240 | 371 | 6 | 1 | 1 |
| South Atlantic States: | | | | | | | | |
| Delaware | 3 | ------ | ------ | 8 | 34 | 129 | 0 | 1 |
| Maryland [2] | 15 | 13 | 31 | 389 | 54 | 412 | 2 | 5 |
| District of Columbia | 7 | 5 | 1 | 27 | 6 | ------ | 0 | 2 |
| Virginia | 15 | 15 | ------ | ------ | 439 | 188 | 8 | 9 |
| West Virginia | 7 | 12 | 80 | 725 | 391 | 3 | 11 | 9 |
| North Carolina | 17 | 29 | 25 | 93 | 2,357 | 55 | 3 | 1 |
| South Carolina [3] | 4 | 4 | 635 | 1,116 | 418 | 12 | 1 | 1 |
| Georgia [3] | 10 | 13 | ------ | 1,189 | 1,576 | ------ | 2 | 3 |
| Florida [3] | 5 | 11 | 5 | 36 | 413 | 8 | 3 | 2 |
| East South Central States: | | | | | | | | |
| Kentucky | 19 | 9 | 49 | 521 | 689 | 70 | 15 | 24 |
| Tennessee | 5 | 22 | 101 | 750 | 511 | 21 | 2 | 6 |
| Alabama [3] | 10 | 14 | 260 | 1,154 | 629 | 2 | 5 | 6 |
| Mississippi [3] | 5 | 3 | ------ | ------ | ------ | ------ | 2 | 0 |

See footnotes at end of table.

*Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Feb. 19, 1938, and Feb. 20, 1937*—Continued

| Division and State | Diphtheria | | Influenza | | Measles | | Meningococcus meningitis | |
|---|---|---|---|---|---|---|---|---|
| | Week ended Feb. 19, 1938 | Week ended Feb. 20, 1937 | Week ended Feb. 19, 1938 | Week ended Feb. 20, 1937 | Week ended Feb. 19, 1938 | Week ended Feb. 20, 1937 | Week ended Feb. 19, 1938 | Week ended Feb. 20, 1937 |
| West South Central States: | | | | | | | | |
| Arkansas | 13 | 6 | 219 | 798 | 445 | 3 | 3 | 3 |
| Louisiana [3] | 10 | 13 | 15 | 375 | 11 | 1 | 3 | 1 |
| Oklahoma [4] | 7 | 8 | 217 | 1,018 | 34 | 6 | 1 | 5 |
| Texas [1] | 58 | 56 | 859 | 4,284 | 170 | 522 | 1 | 8 |
| Mountain States: | | | | | | | | |
| Montana | 1 | | | 276 | 8 | | 0 | 2 |
| Idaho | 1 | | 10 | 9 | 3 | 29 | 0 | 1 |
| Wyoming | 1 | | 1 | 1 | 3 | 1 | 0 | 0 |
| Colorado | 13 | 4 | | | 393 | 1 | 0 | 0 |
| New Mexico | 6 | 2 | 1 | 287 | 83 | 63 | 0 | 2 |
| Arizona | 1 | 2 | 157 | 401 | 15 | 208 | 0 | 2 |
| Utah [2] | 5 | 2 | | | 158 | 11 | 0 | 0 |
| Pacific States: | | | | | | | | |
| Washington | 2 | 1 | | 51 | 10 | 12 | 2 | 1 |
| Oregon | 5 | | 71 | 352 | 16 | 12 | 2 | 0 |
| California | 28 | 30 | 57 | 4,126 | 205 | 83 | 4 | 11 |
| Total | 539 | 512 | 3,167 | 21,931 | 34,711 | 5,546 | 102 | 184 |
| First 7 weeks of year | 4,594 | 4,086 | 21,587 | 190,908 | 162,975 | 31,625 | 654 | 1,067 |

| Division and State | Poliomyelitis | | Scarlet fever | | Smallpox | | Typhoid and paratyphoid fevers | | Whooping cough |
|---|---|---|---|---|---|---|---|---|---|
| | Week ended Feb. 19, 1938 | Week ended Feb. 20, 1937 | Week ended Feb. 19, 1938 | Week ended Feb. 20, 1937 | Week ended Feb. 19, 1938 | Week ended Feb. 20, 1937 | Week ended Feb. 19, 1938 | Week ended Feb. 20, 1937 | Week ended Feb. 19, 1938 |
| New England States: | | | | | | | | | |
| Maine | 0 | 0 | 9 | 23 | 0 | 0 | 3 | 0 | 52 |
| New Hampshire | 0 | 0 | 47 | 6 | 0 | 0 | 0 | 0 | 2 |
| Vermont | 0 | 0 | 7 | 11 | 0 | 0 | 2 | 0 | 25 |
| Massachusetts | 0 | 0 | 311 | 252 | 0 | 0 | 2 | 2 | 104 |
| Rhode Island | 0 | 0 | 19 | 58 | 0 | 0 | 0 | 1 | 37 |
| Connecticut | 0 | 0 | 109 | 105 | 0 | 0 | 0 | 1 | 45 |
| Middle Atlantic States: | | | | | | | | | |
| New York | 0 | 0 | 771 | 1,107 | 0 | 0 | 3 | 6 | 505 |
| New Jersey | 1 | 0 | 139 | 204 | 0 | 0 | 3 | 2 | 200 |
| Pennsylvania | 0 | 1 | 552 | 834 | 0 | 0 | 3 | 4 | 361 |
| East North Central States: | | | | | | | | | |
| Ohio | 1 | 0 | 198 | 212 | 4 | 1 | 0 | 1 | 87 |
| Indiana | 0 | 1 | 111 | 165 | 17 | 2 | 0 | 1 | 27 |
| Illinois | 0 | 0 | 684 | 657 | 25 | 40 | 5 | 6 | 76 |
| Michigan [2] | 1 | 2 | 624 | 785 | 15 | 0 | 19 | 2 | 187 |
| Wisconsin | 0 | 0 | 264 | 320 | 4 | 5 | 2 | 0 | 102 |
| West North Central States: | | | | | | | | | |
| Minnesota | 0 | 1 | 151 | 199 | 21 | 8 | 1 | 0 | 39 |
| Iowa | 0 | 0 | 203 | 288 | 46 | 29 | 0 | 0 | 34 |
| Missouri | 2 | 0 | 170 | 301 | 47 | 70 | 7 | 1 | 52 |
| North Dakota | 0 | 0 | 42 | 59 | 41 | 6 | 0 | 2 | 19 |
| South Dakota | 0 | 0 | 11 | 69 | 0 | 3 | 0 | 0 | 26 |
| Nebraska | 1 | 0 | 57 | 112 | 16 | 3 | 0 | 0 | 10 |
| Kansas | 0 | 0 | 201 | 279 | 13 | 20 | 6 | 0 | 138 |
| South Atlantic States: | | | | | | | | | |
| Delaware | 0 | 0 | 11 | 18 | 0 | 0 | 0 | 3 | 8 |
| Maryland [2] | 1 | 0 | 56 | 42 | 0 | 0 | 4 | 1 | 64 |
| District of Columbia | 0 | 0 | 20 | 23 | 0 | 0 | 1 | 1 | 9 |
| Virginia | 0 | 1 | 37 | 16 | 0 | 0 | 3 | 2 | 99 |
| West Virginia | 1 | 1 | 53 | 57 | 0 | 3 | 10 | 1 | 59 |
| North Carolina | 2 | 0 | 33 | 42 | 2 | 0 | 1 | 1 | 343 |
| South Carolina [3] | 0 | 0 | 14 | 3 | 0 | 0 | 1 | 5 | 68 |
| Georgia [3] | 0 | 1 | 18 | 7 | 1 | 0 | 5 | 3 | 33 |
| Florida [3] | 2 | 0 | 22 | 8 | 0 | 0 | 2 | 2 | 9 |
| East South Central States: | | | | | | | | | |
| Kentucky | 0 | 2 | 106 | 43 | 14 | 0 | 3 | 11 | 98 |
| Tennessee | 1 | 0 | 12 | 28 | 10 | 0 | 1 | 7 | 18 |
| Alabama [2] | 0 | 0 | 28 | 13 | 0 | 0 | 1 | 3 | 21 |
| Mississippi [2] | 1 | 0 | 8 | 7 | 8 | 1 | 3 | 4 | |

See footnotes at end of table.

*Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Feb. 19, 1938, and Feb. 20, 1937*—Continued

| Division and State | Poliomyelitis | | Scarlet fever | | Smallpox | | Typhoid and paratyphoid fevers | | Whooping cough |
|---|---|---|---|---|---|---|---|---|---|
| | Week ended Feb. 19, 1938 | Week ended Feb. 20, 1937 | Week ended Feb. 19, 1938 | Week ended Feb. 20, 1937 | Week ended Feb. 19, 1938 | Week ended Feb. 20, 1937 | Week ended Feb. 19, 1938 | Week ended Feb. 20, 1937 | Week ended Feb. 19, 1938 |
| West South Central States: | | | | | | | | | |
| Arkansas | 0 | 3 | 17 | 10 | 20 | 4 | 4 | 0 | 144 |
| Louisiana [2] | 0 | 1 | 7 | 8 | 1 | 0 | 21 | 5 | 20 |
| Oklahoma [4] | 1 | 1 | 44 | 31 | 12 | 1 | 3 | 2 | 29 |
| Texas [3] | 2 | 2 | 128 | 108 | 19 | 2 | 19 | 10 | 214 |
| Mountain States: | | | | | | | | | |
| Montana | 0 | 0 | 18 | 51 | 6 | 11 | 1 | 1 | 19 |
| Idaho | 3 | 1 | 22 | 32 | 19 | 4 | 0 | 4 | 14 |
| Wyoming | 0 | 0 | 13 | 11 | 0 | 0 | 0 | 0 | 17 |
| Colorado | 1 | 0 | 33 | 34 | 7 | 7 | 1 | 0 | 8 |
| New Mexico | 0 | 0 | 10 | 40 | 0 | 3 | 0 | 3 | 17 |
| Arizona | 0 | 0 | 13 | 30 | 1 | 0 | 2 | 2 | 19 |
| Utah [2] | 0 | 0 | 77 | 14 | 2 | 0 | 0 | 0 | 30 |
| Pacific States: | | | | | | | | | |
| Washington | 1 | 0 | 57 | 52 | 34 | 2 | 0 | 1 | 141 |
| Oregon | 2 | 0 | 68 | 41 | 23 | 19 | 1 | 2 | 43 |
| California | 2 | 0 | 176 | 252 | 25 | 9 | 1 | 2 | 293 |
| Total | 26 | 18 | 5,781 | 7,067 | 453 | 253 | 144 | 105 | 3,965 |
| First 7 weeks of year | 150 | 159 | 41,718 | 43,602 | 4,071 | 2,081 | 851 | 803 | 27,869 |

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Typhus fever, week ended Feb. 19, 1938, 20 cases, as follows: South Carolina, 2; Georgia, 5; Florida, 1; Alabama, 3; Louisiana, 1; Texas, 8.
[4] Figures for 1937 are exclusive of Oklahoma City and Tulsa.
[5] The number of cases of measles in the State of New York for the week ended Feb. 5, 1938 (Public Health Reports of Feb. 18, p. 271), should have been given as 706 instead of 4,706 as reported through an error in transmission.

## SUMMARY OF MONTHLY REPORTS FROM STATES

The following summary of cases reported monthly by States is published weekly and covers only those States from which reports are received during the current week.

| State | Meningococcus meningitis | Diphtheria | Influenza | Malaria | Measles | Pellagra | Poliomyelitis | Scarlet fever | Smallpox | Typhoid fever |
|---|---|---|---|---|---|---|---|---|---|---|
| *September 1937* | | | | | | | | | | |
| Arizona | 0 | 22 | 71 | 3 | 26 | 1 | 7 | 19 | 0 | 12 |
| *November 1937* | | | | | | | | | | |
| South Carolina | ---- | 173 | 835 | 493 | 63 | 46 | 1 | 30 | 0 | 5 |
| *December 1937* | | | | | | | | | | |
| South Carolina | ---- | 148 | 1,202 | 136 | 154 | 45 | ---- | 31 | 0 | 6 |
| *January 1938* | | | | | | | | | | |
| Alabama | 48 | 80 | 1,782 | 37 | 640 | 25 | 6 | 101 | 13 | 14 |
| Illinois | 15 | 176 | 137 | 10 | 13,423 | 3 | 5 | 3,080 | 257 | 9 |
| Iowa | 8 | 22 | 15 | ---- | 226 | ---- | 1 | 993 | 243 | 2 |
| Maine | 2 | 12 | 30 | ---- | 341 | ---- | 0 | 109 | 0 | 8 |
| Maryland | 8 | 52 | 109 | ---- | 69 | ---- | 2 | 242 | 0 | 11 |
| Michigan | 7 | 57 | 9 | ---- | 3,056 | ---- | 1 | 2,245 | 16 | 9 |
| Minnesota | 7 | 33 | 10 | ---- | 42 | ---- | 4 | 644 | 255 | 5 |
| Missouri | 6 | 161 | 619 | 9 | 6,384 | 1 | 2 | 1,278 | 242 | 31 |
| Nebraska | 3 | 8 | 14 | ---- | 16 | ---- | 1 | 168 | 5 | 5 |
| New Jersey | 11 | 62 | 50 | ---- | 4,105 | ---- | 1 | 524 | 0 | 6 |
| Ohio | 10 | 127 | 130 | ---- | 4,587 | ---- | 5 | 1,672 | 22 | 10 |
| South Carolina | ---- | 120 | 2,968 | 275 | 814 | 49 | 0 | 20 | 1 | 13 |
| West Virginia | 19 | 74 | 254 | ---- | 1,447 | ---- | 1 | 315 | 2 | 14 |

## *Summary of monthly reports from States*—Continued

*September 1937*

| Arizona: | Cases |
|---|---|
| Chickenpox | 2 |
| Dysentery | 52 |
| Encephalitis, epidemic or lethargic | 3 |
| Mumps | 8 |
| Trachoma | 42 |
| Undulant fever | 2 |
| Whooping cough | 45 |

*November 1937*

| South Carolina: | |
|---|---|
| Chickenpox | 78 |
| Diarrhea | 158 |
| Dysentery (amoebic) | 1 |
| German measles | 1 |
| Hookworm disease | 58 |
| Mumps | 32 |
| Ophthalmia neonatorum | 1 |
| Paratyphoid fever | 1 |
| Rabies in animals | 26 |
| Septic sore throat | 4 |
| Tularaemia | 1 |
| Typhus fever | 14 |
| Whooping cough | 125 |

*December 1937*

| South Carolina: | |
|---|---|
| Chickenpox | 125 |
| Dengue | 1 |
| Diarrhea | 142 |
| German measles | 1 |
| Hookworm disease | 25 |
| Mumps | 28 |
| Ophthalmia neonatorum | 1 |
| Rabies in animals | 24 |
| Septic sore throat | 6 |
| Tularaemia | 1 |
| Typhus fever | 9 |
| Undulant fever | 1 |
| Whooping cough | 129 |

*January 1938*

| Actinomycosis: | |
|---|---|
| Michigan | 1 |
| Minnesota | 1 |
| Anthrax: | |
| Ohio | 1 |
| Chickenpox: | |
| Alabama | 338 |
| Illinois | 2,442 |
| Iowa | 517 |
| Maine | 400 |
| Maryland | 781 |
| Michigan | 2,077 |
| Minnesota | 853 |
| Missouri | 699 |
| Nebraska | 234 |
| New Jersey | 3,127 |
| Ohio | 2,381 |
| South Carolina | 294 |
| West Virginia | 279 |
| Dengue: | |
| Alabama | 1 |
| South Carolina | 2 |
| Diarrhea: | |
| Maryland | 4 |
| Ohio (under 2 years; enteritis included) | 13 |
| South Carolina | 191 |

*January 1938*—Continued

| Dysentery: | Cases |
|---|---|
| Illinois (amoebic) | 2 |
| Illinois (amoebic carriers) | 18 |
| Illinois (bacillary) | 15 |
| Maryland (bacillary) | 6 |
| Michigan (amoebic) | 2 |
| Michigan (bacillary) | 1 |
| Minnesota (amoebic) | 1 |
| Minnesota (bacillary) | 1 |
| Missouri | 9 |
| New Jersey (amoebic) | 1 |
| Ohio (amoebic) | 1 |
| Ohio (bacillary) | 1 |
| Encephalitis, epidemic or lethargic: | |
| Alabama | 1 |
| Illinois | 8 |
| Iowa | 3 |
| Michigan | 1 |
| Minnesota | 1 |
| Missouri | 1 |
| New Jersey | 2 |
| Ohio | 2 |
| German measles: | |
| Alabama | 10 |
| Illinois | 95 |
| Iowa | 2 |
| Maine | 30 |
| Maryland | 8 |
| Michigan | 106 |
| New Jersey | 83 |
| Ohio | 24 |
| South Carolina | 2 |
| Hookworm disease: | |
| South Carolina | 67 |
| Impetigo contagiosa: | |
| Maryland | 16 |
| Lead poisoning: | |
| Ohio | 11 |
| Mumps: | |
| Alabama | 88 |
| Illinois | 990 |
| Iowa | 54 |
| Maine | 262 |
| Maryland | 58 |
| Michigan | 1,267 |
| Missouri | 254 |
| Nebraska | 82 |
| New Jersey | 696 |
| Ohio | 390 |
| South Carolina | 140 |
| West Virginia | 46 |
| Ophthalmia neonatorum: | |
| Alabama | 2 |
| Illinois | 2 |
| Maryland | 3 |
| New Jersey | 6 |
| Ohio | 73 |
| South Carolina | 2 |
| Puerperal septicemia: | |
| Ohio | 2 |
| Rabies in animals: | |
| Alabama | 92 |
| Illinois | 31 |
| Maryland | 1 |
| Michigan | 5 |
| Missouri | 12 |
| New Jersey | 5 |
| South Carolina | 40 |
| Rabies in man: | |
| Michigan | 1 |
| Ohio | 1 |
| Rocky Mountain spotted fever: | |
| Maryland | 2 |

*January 1938*—Continued

| Scabies: | Cases |
|---|---|
| Maryland | 1 |
| Septic sore throat: | |
| Illinois | 14 |
| Iowa | 7 |
| Maine | 1 |
| Maryland | 18 |
| Michigan | 51 |
| Minnesota | 18 |
| Missouri | 99 |
| Nebraska | 1 |
| New Jersey | 27 |
| Ohio | 115 |
| Tetanus: | |
| Illinois | 4 |
| Maryland | 1 |
| Michigan | 1 |
| Missouri | 1 |
| Ohio | 3 |
| South Carolina | 3 |
| Trachoma: | |
| Illinois | 26 |
| Michigan | 2 |
| Minnesota | 1 |
| Missouri | 24 |
| New Jersey | 1 |
| Trichinosis: | |
| Maine | 1 |
| Maryland | 2 |
| New Jersey | 2 |
| Ohio | 2 |
| Tularaemia: | |
| Alabama | 3 |
| Illinois | 18 |
| Iowa | 3 |
| Maryland | 1 |
| Michigan | 1 |
| Minnesota | 1 |
| Missouri | 24 |
| Ohio | 9 |
| South Carolina | 2 |
| Typhus fever: | |
| Alabama | 21 |
| Illinois | 1 |
| Maryland | 1 |
| South Carolina | 9 |
| Undulant fever: | |
| Alabama | 3 |
| Illinois | 3 |
| Iowa | 7 |
| Maine | 2 |
| Maryland | 2 |
| Michigan | 9 |
| Minnesota | 5 |
| Missouri | 1 |
| New Jersey | 4 |
| Ohio | 9 |
| West Virginia | 1 |
| Vincent's infection: | |
| Illinois | 15 |
| Maine | 27 |
| Maryland | 20 |
| Michigan | 16 |
| Whooping cough: | |
| Alabama | 121 |
| Illinois | 456 |
| Iowa | 170 |
| Maine | 402 |
| Maryland | 218 |
| Michigan | 817 |
| Minnesota | 175 |
| Missouri | 473 |
| Nebraska | 40 |
| New Jersey | 694 |
| Ohio | 475 |
| South Carolina | 219 |
| West Virginia | 550 |

## WEEKLY REPORTS FROM CITIES

*City reports for week ended Feb. 12, 1938*

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table. Weekly reports are received from about 700 cities, from which the data are tabulated and filed for reference.

| State and city | Diphtheria cases | Influenza | | Measles cases | Pneumonia deaths | Scarlet fever cases | Smallpox cases | Tuberculosis deaths | Typhoid fever cases | Whooping cough cases | Deaths, all causes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cases | Deaths | | | | | | | | |
| Data for 90 cities: | | | | | | | | | | | |
| 5-year average | 214 | 1,277 | 171 | 3,850 | 993 | 2,085 | 25 | 411 | 19 | 1,165 | ---- |
| Current week [1] | 169 | 212 | 63 | 8,518 | 802 | 1,695 | 36 | 351 | 17 | 906 | ---- |
| Maine: | | | | | | | | | | | |
| Portland | 0 | ---- | 0 | 15 | 0 | 2 | 0 | 0 | 0 | 29 | 29 |
| New Hampshire: | | | | | | | | | | | |
| Concord | 0 | ---- | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 3 | 8 |
| Manchester | 0 | ---- | 0 | 1 | 3 | 5 | 0 | 0 | 0 | 0 | 10 |
| Nashua | 0 | ---- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 |
| Vermont: | | | | | | | | | | | |
| Barre | 0 | ---- | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| Burlington | 0 | ---- | 0 | 8 | 0 | 1 | 0 | 0 | 0 | 3 | 9 |
| Rutland | 0 | ---- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| Massachusetts: | | | | | | | | | | | |
| Boston | 1 | ---- | 0 | 96 | 21 | 66 | 0 | 4 | 0 | 13 | 227 |
| Fall River | 0 | ---- | 2 | 0 | 2 | 3 | 0 | 0 | 0 | 10 | 22 |
| Springfield | 0 | ---- | 0 | 1 | 5 | 9 | 0 | 0 | 0 | 3 | 40 |
| Worcester | 0 | ---- | 0 | 3 | 14 | 21 | 0 | 1 | 0 | 1 | 61 |
| Rhode Island: | | | | | | | | | | | |
| Pawtucket | 0 | ---- | 0 | 0 | 2 | 7 | 0 | 2 | 0 | 0 | 16 |
| Providence | 0 | ---- | 1 | 1 | 6 | 22 | 0 | 4 | 0 | 15 | 70 |
| Connecticut: | | | | | | | | | | | |
| Bridgeport | 3 | 1 | 1 | 0 | 4 | 31 | 0 | 2 | 0 | 0 | 25 |
| Hartford | 0 | ---- | 0 | 0 | 7 | 21 | 0 | 0 | 0 | 0 | 45 |
| New Haven | 0 | ---- | 0 | 1 | 2 | 3 | 0 | 0 | 0 | 1 | 39 |
| New York: | | | | | | | | | | | |
| Buffalo | 0 | ---- | 0 | 2 | 14 | 30 | 0 | 3 | 0 | 14 | 139 |
| New York | 29 | 18 | 2 | 236 | 120 | 291 | 0 | 83 | 2 | 167 | 1,505 |
| Rochester | 1 | 2 | 0 | 6 | 4 | 9 | 0 | 1 | 0 | 7 | 65 |
| Syracuse [2] | 2 | ---- | 0 | 14 | 5 | 18 | 0 | 1 | 0 | 5 | 63 |
| New Jersey: | | | | | | | | | | | |
| Camden | 2 | ---- | 0 | 43 | 7 | 3 | 0 | 1 | 0 | 1 | 42 |
| Newark | 0 | ---- | 0 | 20 | 8 | 4 | 0 | 5 | 0 | 18 | 99 |
| Trenton | 0 | ---- | 0 | 13 | 5 | 2 | 0 | 1 | 0 | 6 | 49 |
| Pennsylvania: | | | | | | | | | | | |
| Philadelphia | 8 | 5 | 5 | 483 | 30 | 98 | 0 | 18 | 1 | 41 | 491 |
| Pittsburgh | 0 | 5 | 1 | 253 | 27 | 47 | 0 | 7 | 1 | 14 | 180 |
| Reading | 1 | ---- | 0 | 5 | 1 | 4 | 0 | 1 | 1 | 1 | 23 |
| Scranton | 0 | ---- | ---- | 36 | ---- | 1 | 0 | ---- | 0 | 2 | ---- |
| Ohio: | | | | | | | | | | | |
| Cincinnati | 1 | 1 | 1 | 2 | 12 | 24 | 0 | 8 | 0 | 4 | 131 |
| Cleveland | 4 | 13 | 0 | 136 | 14 | 82 | 0 | 6 | 0 | 38 | 193 |
| Columbus | 0 | ---- | 0 | 128 | 5 | 6 | 0 | 4 | 0 | 3 | 74 |
| Toledo | 3 | 3 | 1 | 100 | 6 | 11 | 0 | 5 | 0 | 17 | 67 |
| Indiana: | | | | | | | | | | | |
| Anderson | 0 | ---- | 0 | 2 | 0 | 8 | 9 | 0 | 0 | 5 | 8 |
| Fort Wayne | 0 | ---- | 0 | 30 | 3 | 17 | 1 | 1 | 0 | 0 | 28 |
| Indianapolis | 16 | ---- | 0 | 51 | 14 | 18 | 0 | 6 | 0 | 3 | 103 |
| Muncie | 0 | ---- | 0 | 59 | 1 | 0 | 0 | 0 | 0 | 0 | 15 |
| South Bend | 0 | ---- | 1 | 2 | 3 | 4 | 0 | 0 | 0 | 0 | 21 |
| Terre Haute | 8 | ---- | 0 | 14 | 0 | 2 | 0 | 0 | 0 | 0 | 15 |
| Illinois: | | | | | | | | | | | |
| Alton | 0 | ---- | 0 | 0 | 2 | 9 | 0 | 0 | 0 | 0 | 11 |
| Chicago | 8 | 16 | 3 | 2,359 | 63 | 275 | 0 | 38 | 0 | 34 | 762 |
| Elgin | 0 | ---- | 0 | 6 | 2 | 12 | 0 | 0 | 0 | 1 | 13 |
| Moline | 0 | ---- | 0 | 50 | 0 | 16 | 0 | 0 | 1 | 1 | 6 |
| Springfield | 1 | ---- | 0 | 0 | 5 | 6 | 1 | 0 | 0 | 0 | 30 |
| Michigan: | | | | | | | | | | | |
| Detroit | 11 | 3 | 3 | 1,242 | 19 | 172 | 0 | 11 | 1 | 83 | 240 |
| Flint | 0 | ---- | 0 | 7 | 2 | 21 | 0 | 0 | 0 | 20 | 16 |
| Grand Rapids | 0 | ---- | 0 | 15 | 3 | 15 | 0 | 1 | 0 | 6 | 35 |
| Wisconsin: | | | | | | | | | | | |
| Kenosha | 0 | ---- | 0 | 5 | 2 | 0 | 0 | 0 | 0 | 3 | 10 |
| Madison | 1 | ---- | 0 | 0 | 7 | 9 | 0 | 0 | 0 | 3 | 36 |
| Milwaukee | 2 | ---- | 0 | 1,688 | 5 | 24 | 0 | 4 | 0 | 22 | 99 |
| Racine | 0 | ---- | 0 | 6 | 2 | 22 | 0 | 2 | 1 | 0 | 17 |
| Superior | 0 | ---- | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 12 |

[1] Figures for Winston-Salem and Savannah estimated; reports not received.

[2] The report of 1 case of encephalitis in Syracuse for the week ended Jan. 1, Public Health Reports, Jan. 21, 1938, p. 108, was in error, no case of the disease having occurred.

*City reports for week ended Feb. 12, 1938*—Continued

| State and city | Diphtheria cases | Influenza | | Measles cases | Pneumonia deaths | Scarlet fever cases | Smallpox cases | Tuberculosis deaths | Typhoid fever cases | Whooping cough cases | Deaths, all causes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cases | Deaths | | | | | | | | |
| Minnesota: | | | | | | | | | | | |
| Duluth | 0 | ---- | 0 | 0 | 1 | 5 | 0 | 1 | 0 | 7 | 22 |
| Minneapolis | 0 | ---- | 1 | 4 | 4 | 13 | 4 | 0 | 0 | 1 | 105 |
| St. Paul | 1 | 1 | 1 | 0 | 7 | 7 | 5 | 0 | 0 | 4 | 59 |
| Iowa: | | | | | | | | | | | |
| Cedar Rapids | 0 | ---- | ---- | 1 | ---- | 1 | 0 | ---- | 0 | 0 | ---- |
| Davenport | 1 | ---- | ---- | 15 | ---- | 3 | 0 | ---- | 0 | 0 | ---- |
| Des Moines | 0 | ---- | ---- | 0 | ---- | 31 | 2 | ---- | 0 | 0 | 38 |
| Sioux City | 1 | ---- | ---- | 0 | ---- | 6 | 0 | ---- | 0 | 1 | ---- |
| Waterloo | 2 | ---- | ---- | 0 | ---- | 3 | 0 | ---- | 0 | 0 | ---- |
| Missouri: | | | | | | | | | | | |
| Kansas City | 0 | 3 | 2 | 122 | 16 | 18 | 1 | 7 | 0 | 4 | 132 |
| St. Joseph | 0 | ---- | 0 | 10 | 10 | 2 | 0 | 1 | 0 | 0 | 45 |
| St. Louis | 5 | ---- | 1 | 42 | 11 | 57 | 2 | 6 | 0 | 3 | 211 |
| North Dakota: | | | | | | | | | | | |
| Fargo | 0 | ---- | 0 | 0 | 1 | 7 | 0 | 0 | 0 | 4 | 5 |
| Grand Forks | 0 | ---- | ---- | 1 | ---- | 1 | 0 | ---- | 0 | 0 | ---- |
| Minot | 0 | ---- | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 4 | 6 |
| South Dakota: | | | | | | | | | | | |
| Aberdeen | 0 | ---- | ---- | 0 | ---- | 1 | 0 | ---- | 0 | 1 | ---- |
| Sioux Falls | 0 | ---- | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 8 |
| Nebraska: | | | | | | | | | | | |
| Lincoln | 2 | ---- | ---- | 3 | ---- | 14 | 0 | ---- | 0 | 3 | ---- |
| Omaha | 0 | ---- | 0 | 2 | 8 | 6 | 1 | 0 | 0 | 0 | 60 |
| Kansas: | | | | | | | | | | | |
| Lawrence | 0 | ---- | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 3 | 11 |
| Topeka | 0 | ---- | 0 | 5 | 3 | 0 | 0 | 0 | 0 | 16 | 15 |
| Wichita | 1 | ---- | 0 | 2 | 10 | 5 | 0 | 1 | 0 | 1 | 36 |
| Delaware: | | | | | | | | | | | |
| Wilmington | 0 | ---- | 0 | 11 | 8 | 3 | 0 | 1 | 0 | 3 | 36 |
| Maryland: | | | | | | | | | | | |
| Baltimore | 13 | 8 | 3 | 7 | 32 | 31 | 0 | 9 | 0 | 41 | 238 |
| Cumberland | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 14 |
| Frederick | 0 | ---- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| District of Columbia: | | | | | | | | | | | |
| Washington | 10 | 1 | 0 | 11 | 20 | 15 | 0 | 8 | 0 | 12 | 161 |
| Virginia: | | | | | | | | | | | |
| Lynchburg | 3 | ---- | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 3 | 9 |
| Norfolk | 1 | ---- | 0 | 79 | 3 | 5 | 0 | 2 | 0 | 2 | 27 |
| Richmond | 0 | ---- | 0 | 66 | 13 | 4 | 0 | 6 | 1 | 1 | 67 |
| Roanoke | 0 | ---- | 0 | 0 | 1 | 1 | 0 | 2 | 0 | 0 | 15 |
| West Virginia: | | | | | | | | | | | |
| Charleston | 0 | ---- | 0 | 114 | 3 | 1 | 0 | 1 | 0 | 0 | 11 |
| Huntington | 0 | ---- | ---- | 10 | ---- | 0 | 0 | ---- | 0 | 0 | ---- |
| Wheeling | 0 | ---- | 0 | 8 | 6 | 2 | 0 | 1 | 0 | 2 | 24 |
| North Carolina: | | | | | | | | | | | |
| Gastonia | 0 | ---- | ---- | 0 | ---- | 0 | 0 | ---- | 0 | 1 | ---- |
| Raleigh | 0 | ---- | 0 | 11 | 1 | 0 | 0 | 1 | 0 | 29 | 8 |
| Wilmington | 0 | ---- | 0 | 14 | 3 | 0 | 0 | 1 | 0 | 13 | 10 |
| Winston-Salem | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| South Carolina: | | | | | | | | | | | |
| Charleston | 0 | 30 | 3 | 87 | 4 | 0 | 0 | 4 | 1 | 0 | 29 |
| Florence | 0 | ---- | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| Greenville | 0 | ---- | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 9 | 8 |
| Georgia: | | | | | | | | | | | |
| Atlanta | 0 | 16 | 2 | 179 | 16 | 6 | 0 | 3 | 0 | 3 | 107 |
| Brunswick | 0 | ---- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| Savannah | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| Florida: | | | | | | | | | | | |
| Miami | 1 | 1 | 0 | 108 | 3 | 1 | 0 | 1 | 0 | 0 | 39 |
| Tampa | 1 | ---- | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 28 |
| Kentucky: | | | | | | | | | | | |
| Covington | 0 | 1 | ---- | 1 | 1 | 3 | 0 | 0 | 0 | 0 | 14 |
| Louisville | 1 | ---- | 0 | 142 | 11 | 29 | 0 | 3 | 0 | 4 | 74 |
| Tennessee: | | | | | | | | | | | |
| Knoxville | 0 | ---- | 2 | 9 | 1 | 2 | 0 | 2 | 0 | 0 | 27 |
| Memphis | 2 | 7 | 3 | 251 | 16 | 4 | 0 | 4 | 0 | 1 | 95 |
| Nashville | 1 | ---- | 0 | 54 | 11 | 6 | 0 | 1 | 0 | 12 | 30 |
| Alabama: | | | | | | | | | | | |
| Birmingham | 1 | 8 | 2 | 190 | 15 | 5 | 0 | 3 | 0 | 0 | 88 |
| Mobile | 0 | ---- | 1 | 12 | 0 | 0 | 0 | 1 | 0 | 0 | 29 |
| Montgomery | 0 | ---- | ---- | 14 | ---- | 0 | 0 | ---- | 0 | 1 | ---- |
| Arkansas: | | | | | | | | | | | |
| Fort Smith | 1 | ---- | 0 | 16 | ---- | 3 | 0 | ---- | 1 | 0 | ---- |
| Little Rock | 0 | ---- | 0 | 106 | 8 | 2 | 0 | 0 | 0 | 0 | 10 |

*City reports for week ended Feb. 12, 1938*—Continued

| State and city | Diphtheria cases | Influenza | | Measles cases | Pneumonia deaths | Scarlet fever cases | Smallpox cases | Tuberculosis deaths | Typhoid fever cases | Whooping cough cases | Deaths, all causes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cases | Deaths | | | | | | | | |
| **Louisiana:** | | | | | | | | | | | |
| Lake Charles | 0 | ------ | 0 | 0 | 1 | 2 | 0 | 3 | 0 | 1 | 7 |
| New Orleans | 3 | 15 | 8 | 0 | 26 | 1 | 0 | 11 | 2 | 10 | 160 |
| Shreveport | 0 | ------ | 0 | 5 | 9 | 3 | 0 | 2 | 0 | 0 | 35 |
| **Oklahoma:** | | | | | | | | | | | |
| Muskogee | 0 | ------ | ------ | 0 | ------ | 1 | 0 | ------ | 0 | 0 | ------ |
| Oklahoma City | 2 | 3 | 0 | 0 | 6 | 4 | 0 | 0 | 0 | 2 | 59 |
| Tulsa | 1 | ------ | ------ | 3 | ------ | 5 | 0 | ------ | 0 | 13 | ------ |
| **Texas:** | | | | | | | | | | | |
| Dallas | 1 | 1 | 1 | 4 | 7 | 17 | 0 | 2 | 1 | 2 | 76 |
| Fort Worth | 3 | ------ | 2 | 1 | 12 | 6 | 3 | 2 | 0 | 4 | 49 |
| Galveston | 1 | ------ | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 21 |
| Houston | 3 | ------ | 0 | 2 | 6 | 5 | 0 | 3 | 1 | 0 | 70 |
| San Antonio | 3 | ------ | 3 | 0 | 4 | 0 | 0 | 7 | 0 | 3 | 60 |
| **Montana:** | | | | | | | | | | | |
| Billings | 0 | ------ | 0 | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 10 |
| Great Falls | 0 | ------ | 0 | 0 | 1 | 0 | 4 | 0 | 0 | 9 | 6 |
| Helena | 0 | ------ | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 4 | 5 |
| Missoula | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| **Idaho:** | | | | | | | | | | | |
| Boise | 0 | ------ | 0 | 0 | 0 | 1 | 8 | 0 | 0 | 0 | 5 |
| **Colorado:** | | | | | | | | | | | |
| Colorado Springs | 0 | ------ | 0 | 1 | 0 | 4 | 0 | 1 | 0 | 1 | 9 |
| Denver | 5 | ------ | 1 | 237 | 10 | 21 | 1 | 4 | 0 | 0 | 62 |
| Pueblo | 0 | ------ | 0 | 1 | 3 | 3 | 0 | 0 | 0 | 7 | 10 |
| **New Mexico:** | | | | | | | | | | | |
| Albuquerque | 0 | ------ | 1 | 9 | 1 | 6 | 0 | 6 | 0 | 1 | 18 |
| **Utah:** | | | | | | | | | | | |
| Salt Lake City | 0 | ------ | 1 | 50 | 4 | 13 | 3 | 2 | 0 | 5 | 35 |
| **Washington:** | | | | | | | | | | | |
| Seattle | 3 | ------ | 1 | 4 | 5 | 4 | 1 | 4 | 0 | 50 | 88 |
| Spokane | 0 | 1 | 1 | 0 | 4 | 1 | 0 | 0 | 0 | 1 | 32 |
| Tacoma | 0 | ------ | 0 | 0 | 3 | 5 | 0 | 0 | 0 | 23 | 33 |
| **Oregon:** | | | | | | | | | | | |
| Portland | 2 | 1 | 0 | 3 | 6 | 22 | 2 | 1 | 0 | 0 | 98 |
| Salem | 0 | 1 | ------ | 0 | ------ | 0 | 0 | ------ | 0 | 0 | ------ |
| **California:** | | | | | | | | | | | |
| Los Angeles | 12 | 31 | 3 | 8 | 36 | 32 | 4 | 24 | 1 | 20 | 408 |
| Sacramento | 2 | 1 | 1 | 1 | 3 | 0 | 0 | 1 | 0 | 18 | 25 |
| San Francisco | 0 | ------ | 2 | 3 | 6 | 10 | 0 | 12 | 1 | 25 | 174 |

| State and city | Meningococcus meningitis | | Poliomyelitis cases |
|---|---|---|---|
| | Cases | Deaths | |
| **Massachusetts:** | | | |
| Boston | 1 | 0 | 0 |
| **Rhode Island:** | | | |
| Providence | 1 | 1 | 0 |
| **New York:** | | | |
| Buffalo | 3 | 0 | 0 |
| **Pennsylvania:** | | | |
| Philadelphia | 2 | 0 | 0 |
| **Ohio:** | | | |
| Cleveland | 1 | 1 | 0 |
| Columbus | 1 | 0 | 0 |
| **Indiana:** | | | |
| Indianapolis | 4 | 1 | 0 |
| **Illinois:** | | | |
| Chicago | 2 | 1 | 0 |
| **Michigan:** | | | |
| Detroit | 3 | 1 | 1 |
| **Minnesota:** | | | |
| St. Paul | 1 | 0 | 0 |
| **Iowa:** | | | |
| Des Moines | 1 | 0 | 0 |
| **Missouri:** | | | |
| Kansas City | 1 | 0 | 0 |
| St. Joseph | 0 | 1 | 0 |
| **Maryland:** | | | |
| Baltimore | 2 | 0 | 0 |
| **District of Columbia:** | | | |
| Washington | 1 | 1 | 0 |
| **Virginia:** | | | |
| Norfolk | 1 | 0 | 0 |
| **West Virginia:** | | | |
| Charleston | 1 | 0 | 0 |
| Wheeling | 2 | 0 | 0 |
| **North Carolina:** | | | |
| Wilmington | 1 | 0 | 0 |
| Winston-Salem | 1 | 0 | 0 |
| **Tennessee:** | | | |
| Knoxville | 0 | 1 | 0 |
| **Alabama:** | | | |
| Birmingham | 2 | 1 | 0 |
| **Louisiana:** | | | |
| New Orleans | 1 | 0 | 0 |
| **California:** | | | |
| Los Angeles | 0 | 0 | 1 |

*Encephalitis, epidemic or lethargic.*—Cases: Chicago, 1; Fort Worth, 1; Los Angeles, 1.
*Pellagra.*—Cases: Atlanta, 3; Savannah, 3; New Orleans, 1; Los Angeles, 1.
*Typhus fever.*—Cases: New York, 1; Mobile, 1.

# FOREIGN AND INSULAR

## CUBA

*Habana—Communicable diseases—4 weeks ended January 15, 1938.*—During the 4 weeks ended January 15, 1938, certain communicable diseases were reported in Habana, Cuba, as follows:

| Disease | Cases | Deaths | Disease | Cases | Deaths |
|---|---|---|---|---|---|
| Diphtheria | 16 | | Poliomyelitis | [1] 4 | |
| Leprosy | | 1 | Tuberculosis | 9 | 3 |
| Malaria | [1] 15 | 2 | Typhoid fever | [1] 13 | 4 |

[1] Includes imported cases.

*Provinces—Notifiable diseases—4 weeks ended January 8, 1938.*—During the 4 weeks ended January 8, 1938, cases of certain notifiable diseases were reported in the Provinces of Cuba as follows:

| Disease | Pinar del Rio | Habana | Matanzas | Santa Clara | Camaguey | Oriente | Total |
|---|---|---|---|---|---|---|---|
| Cancer | | 1 | 1 | 7 | | 1 | 10 |
| Chickenpox | | 3 | | | 15 | | 18 |
| Diphtheria | 6 | 12 | | 3 | 5 | 4 | 30 |
| Dysentery (bacillary) | | | | 1 | | | 1 |
| Hookworm disease | | 21 | | 1 | | | 22 |
| Leprosy | | 4 | 1 | 2 | 3 | 2 | 12 |
| Malaria | 38 | 28 | 31 | 75 | 48 | 101 | 321 |
| Measles | 1 | 1 | 1 | | | | 3 |
| Poliomyelitis | | 4 | | 1 | | 3 | 8 |
| Tuberculosis | 37 | 21 | 25 | 38 | 39 | 27 | 189 |
| Typhoid fever | 4 | 23 | 18 | 21 | 1 | 42 | 109 |
| Yaws | | | | | | 27 | 27 |

## CZECHOSLOVAKIA

*Communicable diseases—November 1937.*—During the month of November 1937, certain communicable diseases were reported in Czechoslovakia as follows:

| Disease | Cases | Deaths | Disease | Cases | Deaths |
|---|---|---|---|---|---|
| Anthrax | 4 | | Malaria | 147 | |
| Cerebrospinal meningitis | 7 | 2 | Paratyphoid fever | 15 | |
| Chickenpox | 379 | | Poliomyelitis | 29 | 2 |
| Diphtheria | 4,804 | 188 | Puerperal fever | 41 | 11 |
| Dysentery | 306 | 45 | Scarlet fever | 2,828 | 17 |
| Influenza | 87 | 5 | Trachoma | 92 | |
| Lethargic encephalitis | 3 | 1 | Typhoid fever | 731 | 48 |

## LATVIA

*Notifiable diseases—October–December 1937.*—During the months of October, November, and December 1937, cases of certain notifiable diseases were reported in Latvia as follows:

| Disease | October | November | December | Disease | October | November | December |
|---|---|---|---|---|---|---|---|
| Anthrax | | | 1 | Mumps | 3 | 6 | 18 |
| Botulism | 2 | | | Paratyphoid fever | 17 | 4 | 4 |
| Cerebrospinal meningitis | 9 | 2 | 4 | Poliomyelitis | 21 | 20 | 20 |
| Diphtheria | 113 | 122 | 128 | Puerperal septicemia | 12 | 5 | 5 |
| Epidemic encephalitis | 2 | | 1 | Scarlet fever | 361 | 529 | 489 |
| Erysipelas | 51 | 52 | 56 | Tetanus | 3 | 2 | 2 |
| Influenza | 50 | 100 | 131 | Trachoma | 65 | 77 | 62 |
| Lead poisoning | 1 | | | Tuberculosis | 266 | 261 | 249 |
| Leprosy | | 4 | | Typhoid fever | 78 | 44 | 30 |
| Measles | 5 | 11 | 4 | Undulant fever | | 1 | |
| | | | | Whooping cough | 107 | 247 | 374 |

## CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

NOTE.—A table giving current information of the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS for February 25, 1938, pages 313-327. A similar cumulative table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

### Cholera

*French Indochina.*—During the week ended February 12, 1938, 151 cases of cholera were reported in Annam Province, and 27 cases of cholera in Tonkin Province, French Indochina.

### Plague

*Hawaii Territory—Island of Hawaii—Hamakua District.*—One rat found on February 3, 1938, in Hamakua Mill Sector, and one rat found on February 7 and another rat found on February 10 in Paauhau Sector, all in Hamakua District, Island of Hawaii, Hawaii Territory, have been proved positive for plague.

*Niger (French)—Tanout.*—During the month of December 1937, 145 cases of plague with 109 deaths were reported in northern Tanout, French Niger.

### Smallpox

*Salvador.*—During the month of January 1938, 16 suspected cases of smallpox were reported in Salvador, as follows: Seven cases in San Miguel Department, and nine cases in Sonsonate Department.

*On vessel—"Empress of Japan."*—On February 21, 1938, one case of smallpox (varioloid) was reported in a member of the crew of the S. S. *Empress of Japan*, at Honolulu. It was reported that all sanitary measures had been taken.

**Yellow Fever**

*Belgian Congo—Zongo.*—During the period February 4–12, 1938, four deaths from suspected yellow fever and an additional two cases of suspected yellow fever were reported in Zongo, Belgian Congo.

*Brazil.*—Yellow fever has been reported in Brazil as follows: Minas Geraes State—Gymirim, January 18, one death; Juiz de Fora, January 18, one death, January 25–26, two deaths; Mathias Barbosa, January 20, one death; Rio Novo, January 22, one death. Rio de Janeiro State—Entre Rios, January 21, one death.

*Colombia—Cundinamarca Department—Yacopi.*—On January 15, 1938, one death from yellow fever was reported in Yacopi, Cundinamarca Department, Colombia.

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